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Canotia is named for *Canotia holacantha* Torr. (Celastraceae), a spiny shrub or small tree nearly endemic to Arizona.

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SOLANACEAE PART FOUR:
***PHYSALIS* L. AND *QUINCULA* RAF.**
GROUND CHERRY, TOMATILLO

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Physalis and *Quincula* are two closely related genera and monotypic *Quincula* is sometimes united with *Physalis*. Because the forthcoming treatment of the Solanaceae for the Flora of North America will separate the genera we will follow that decision. In an earlier key to the genera of Arizona Solanaceae (Bates et al. 2009) these taxa were separated only by flower color. We can here improve on that separation with the following key.

1. Flowers erect, the corolla rotate, blue to purple, often with a white center; young growth with inflated globose hairs to ca. 0.1 mm long; seeds triangular with the distal edge crenate. *Quincula*
- 1' Flowers generally nodding, the corolla usually campanulate, or rotate in *P. acutifolia*, yellow to cream or nearly white, with or without central dark spots (urceolate and purplish in *P. solanaceus*); young growth with narrow linear hairs; seeds lenticular without teeth. *Physalis*

Known as “husk cherries” in English and “tomatillos” in Spanish, the species of *Physalis* and *Quincula* have berries enclosed in an inflated calyx. Some species have edible fruits, one of which, *P. philadelphica* Lam. from Mexico, is widely cultivated. The fruits of that species are an important ingredient in “salsa verde” of Mexican cooking. The Asian species *P. alkekengi* L., the “Chinese Lantern Plant” and original type of the genus, has red or orange calyces and is cultivated as an ornamental. Molecular systematic studies (Whitson & Manos 2005) indicate that *P. alkekengi* is not closely related to the American species of *Physalis* and a proposal to conserve the genus with a new type has been put forward (Whitson 2011) so as to retain the name for the greatest number of species. This proposal has been considered by the Nomenclature Committee for Vascular Plants (Taxon 61: 1112. 2012) and it was recommended that *Physalis* be conserved with a new type (*Physalis pubescens* L.).

***Physalis* L.**

Annual or perennial herbs in ours, unarmed, the surfaces often hairy, the hairs simple, or branched, often clearly multicellular with adjacent cells flattened when dry at right angles to each other, sometimes glandular. LEAVES petiolate, membranous

to submembranous, simple, the margins entire to dentate or occasionally lobed, the blade usually longer than the petiole. INFLORESCENCES uniflorous, appearing axillary. FLOWERS 5-merous, actinomorphic, 0.3–1.6 cm long (base of calyx to tip of anthers); calyx lobes acute, usually about as long as or shorter than the tube; corolla rotate, campanulate (sometimes with a reflexed margin) or urceolate, usually yellowish to whitish but less often purplish, often with dark spots (these sometimes merging in a ring) on central inner surface; stamens equal; anthers basifix, oblong, yellow or bluish, opening by lateral slits, the edges of these whitish; filaments longer than the anthers; stigma capitate to weakly bilobed. FRUITS berries, surrounded by an inflated persistent calyx, the inflated calyx derived primarily from the tube, globose to ovoid, often prominently ribbed with obvious reticulate venation between main veins; seeds numerous, lenticular, yellow to orange, 1.5–3 mm wide. —9 spp. in AZ, ca. 80 worldwide. (Greek: for bladder, refers to the inflated calyx.)

We use the terms spreading and erect for hairs, which may not be clear to everyone. Spreading we use to mean extending from the surface in various directions and not appressed. Erect we use to mean perpendicular to a surface.

Kearney and Peebles and collaborators (1960) included *Physalis heterophylla* Nees in *Arizona Flora*. We have not found a specimen to verify its existence in AZ, although some specimens of *P. hederifolia* have been misidentified with that name.

1. Corolla urceolate, 3–5 mm long, purplish to greenish yellow..... ***P. solanaceus***
- 1' Corolla rotate to campanulate, generally over 5 mm long, yellow to white, blue or purple, sometimes with central dark or lighter spots.
 2. Stems glabrous to sparsely appressed pubescent, the hairs when present antrorse, unbranched, rarely over 1 mm long.
 3. Perennials; flower campanulate, 1.1–1.6 cm long; leaf margins entire to repand-sinuate. ***P. longifolia***
 - 3' Annuals; flower rotate to campanulate, if campanulate up to 1 cm long; leaf margins dentate to incised or serrate.
 4. Corolla rotate, 1–2.2 cm wide, yellowish white, occasionally with yellowish-orange darkened center; anthers 3–4 mm long, yellow.
 - ***P. acutifolia***
 - 4' Corolla campanulate, 0.4–1 cm wide, yellow, with a purplish or yellow-green center; anthers 1–2 mm long and yellow, or 3–4 mm long and tinged purplish.
 5. Leaves ovate, lanceolate or elliptic, 1.7–2.2 times as long as wide; corolla 0.8–2.2 cm wide; anthers 3–4 mm long, tinged purplish, twisted when dry. ***P. philadelphica***
 - 5' Leaves elliptic, 2.2–5 times as long as wide; corolla 0.4–1 cm wide; anthers 1–2 mm long, yellow, not twisted when dry.
 - ***P. angulata***
 2. Stems moderately to densely puberulent, pubescent or villous, the hairs erect, spreading or retrorse, sometimes branched, often over 1 mm long.
 6. Plants perennial, the tap root or other underground parts difficult to extract from the soil.

7. Leaves elliptic, rhomboid, or lanceolate, mainly 2.5–4 times as long as wide, the margins entire, sinuate, or coarsely toothed; hairs erect or spreading, ribbon-like, flattened in segments at right angles, mostly 1–2 mm long, not glandular, not branched; pine-oak forest above 1800 m (6000 ft) in e central and s AZ. *P. caudella*

7' Leaves ovate, lanceolate or rhomboid, mainly 1–2.5 times as long as wide, the margin toothed entire, sinuate, dentate or serrate; hairs erect, spreading or retrorse, mostly less than 1 mm long, sometimes glandular, sometimes branched; pinyon-juniper, chaparral and desert, mainly below 1800 m (6000 ft) throughout AZ.

8. Hairs erect, mostly less than 0.25 mm long, unbranched, sometimes inconspicuously glandular, but usually not accumulating debris; leaves ovate, 0.9–1.6 times as long as wide; margins entire, less often repand to sinuate; base cordate-oblique, rarely cuneate; peduncle usually about twice as long as the flower; corolla yellow, without darkened center. *P. crassifolia*

8' Hairs erect to retrorse, mostly greater than 0.25 mm long, often branched and/or obviously glandular, sometimes accumulating debris; leaves lanceolate to ovate or rhomboid, 1–2.5 times longer than wide; margins coarsely dentate or serrate, less often repand; base usually cuneate to truncate-oblique, less often scarcely cordate; peduncle usually about as long as the flower; corolla yellow to greenish yellow, usually with darkened center. *P. hederifolia*

6' Plants annual, the tap root easily extracted from soil.

9. Stems only moderately pubescent, the hairs not glandular; leaves 1.7–2.4 times as long as wide. *P. philadelphica*

9' Stems densely pubescent, the hairs glandular; leaves 0.6–1.2 times as long as wide.

10. Leaves ovate; apex acute to acuminate; base sometimes cordate; marginal teeth acute, few or none; Cochise, Pima and Santa Cruz cos. *P. pubescens*

10' Leaves elliptic to ovate; apex rounded, obtuse or bluntly acute; base rarely cordate; marginal teeth rounded, a few generally present; Yavapai, Coconino, Graham, Greenlee cos. *P. neomexicana*

Physalis acutifolia (Miers) Sandw. (acute-leaved). —Annual herb, with spreading and ascending stems and branches, sparsely antrorsely pubescent on leaf edges and veins, denser on new growth, the stems up to 50 cm long; hairs up to 1 mm long, not glandular. LEAVES elliptic, often narrowly so, less often lanceolate or ovate, 4–12.5 cm long, 1–5 cm wide, 1.8–6 times as long as wide; base acute to acuminate often obliquely so; apex acute to acuminate; margins dentate to incised or serrate. FLOWERS rotate, 0.7–1.2 cm long; peduncle 1.2–3 cm long, usually about 2–3 times as long as flower; calyx 0.3–0.5 cm long, the lobes about as long as the tube; corolla yellowish white, occasionally with yellowish orange darkened center, 1–2.2 cm wide; anthers yellow, 3–4 mm long, about 3–4 times as long as wide. FRUITING CALYX ovoid, 1.2–2.3 cm long, 1–2 cm wide, most about 1.5 cm wide;

berry 0.6–1.3 cm in diameter; seeds lenticular, 2–2.2 mm wide. [*P. wrightii* A. Gray]. —In cultivated lands, riparian areas, or along roadsides; Cochise, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 40–1450 m (130–4750 ft); flowering and fruiting Jul–Sep; s U.S., mainly CA to LA; nw Mex.

Physalis angulata L. (for angled stems). —Annual herb, with spreading and ascending stems and branches, sparsely pubescent on leaf edges and veins, denser on new growth, the stems up to 30 cm long; hairs up to 1 mm long, not glandular. LEAVES elliptic, often narrowly so, 2.5–7 cm long, 0.5–2.5 cm wide, 2.5–5 times as long as wide; base acute to acuminate often obliquely so; apex acute to acuminate; margins dentate to incised or serrate. FLOWERS campanulate, up to 1 cm long; peduncle 0.6–2.5 cm long, usually about 1–2.5 times as long as flower; calyx 0.2–0.5 cm long, the lobes about as long as the tube; corolla yellow, with a purplish or yellow-green darkened center, 0.4–1 cm wide; anthers yellowish, 1–2 mm long, about 2 times as long as wide. FRUITING CALYX ovoid, 1–2.4 cm long, 0.7–2 cm wide; berry 0.5–1 cm in diameter; seeds lenticular, 1.5–2 mm wide. [*P. lanceifolia* Nees]. —Riparian areas; Cochise, Maricopa, Pima, Pinal, Santa Cruz cos.; 100–1400 m (300–4600 ft), mostly around 300 m; flowering and fruiting Jul–Nov; CA to MA, mainly in s states; widespread in temperate and tropical regions.

Physalis caudella Standl. (small tail, for attenuate calyx lobes in fruit) —Perennial herb, ascending, with few branches, usually villous to pubescent, more densely so at nodes, stem bases, leaf mid-veins and leaf margins, peduncles, and flowering calyces, the stems up to 40 cm long; hairs erect or spreading, up to 4.5 mm long, obviously multicellular, the cells flattened, often at perpendicular angles to adjacent cells. LEAVES elliptic, rhomboidal, or lanceolate, 2.5–9.5 cm long, 1–5 cm wide, 2–4 times as long as wide; base usually oblique, rarely cuneate; apex broadly to narrowly acute, rarely broadly acuminate; margins entire, sinuate, or coarsely toothed. FLOWERS campanulate, 0.8–1.1 cm long; peduncle 5–12 mm long, usually 0.6 to 1.1 times as long as flower; calyx 0.7–2 cm long, the lobes about as long as the tube; corolla yellow with purple or brownish center, 1.1–2.1 cm wide; anthers bluish yellow, 2–3.5 mm long. FRUITING CALYX globose to ovoid, 2–5 cm long, 1–3 cm wide; berry 0.4–1.5 cm in diameter; seeds lenticular, ca. 2 mm wide. [*P. lanceolata* auct. non Michx.]. —Canyons, steep slopes, rocky ridges, near streams, and often in loose gravelly sand or soil, pine-oak forests; s Apache, Cochise, Pima, and Santa Cruz cos.; 1800–2800m (6000–9100 ft); flowering and fruiting Aug–Sep; NM; nw Mex.

This species most likely has a large underground taproot or rhizome that is rarely collected due to the difficulty of extracting it from the ground.

Physalis crassifolia Benth. (thick-leaved). —Perennial herb, ascending to trailing-procumbent, inconspicuously puberulent, the trailing stems to 40 cm long; hairs erect, mostly less than 0.25 mm long, sometimes inconspicuously glandular, but not accumulating sand. LEAVES ovate, 1–3.5 cm long, 0.8–3.6 cm wide, 0.9–1.6 times as long as wide, the petiole occasionally longer than the blade; base cordate-oblique, rarely cuneate; apex rounded-acute, occasionally acuminate; margins entire,

less often repand to sinuate. FLOWERS campanulate, 1–1.5 cm long; peduncle 1.1–3.2 cm long, usually about twice as long as the flower; calyx 0.5–0.7 cm long, the lobes shorter than the tube; corolla yellow, without darkened center, 1.1–1.7 cm wide; anthers yellow, 3–3.5 mm long. FRUITING CALYX 1.5–3 cm long, 1.3–2.2 cm wide; berry 0.5–1.2 cm in diameter; seeds reddish orange, lenticular ca. 1.5–2 mm wide, the surface rugose. [*Physalis versicolor* Rydb., *P. crassifolia* var. *versicolor* (Rydb.) Waterf.] —Rocky slopes and canyons, usually in upland Sonoran Desert or Mohave Desert; Coconino, La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai, Yuma cos.; 70–1300 m (250–4000 ft); flowering and fruiting nearly throughout the year but mainly from Mar–Apr and Sep–Oct; CA, NV, UT; nw Mex.

Physalis crassifolia is commonly confused with *P. hederifolia* in AZ. See discussion under that species.

Physalis hederifolia A. Gray (leaves of *Hedera*, ivy) —Perennial herb, usually ascending, puberulent to pubescent, sometimes glandular pubescent, the stems up to 50 em long; hairs greater than or equal to 0.25 mm long, often branched and/or, retrorse and/or obviously glandular, often accumulating sand. LEAVES lanceolate to ovate or rhomboid, 2.5–4 cm long, 1–3.5 cm wide, 1–2.5 times longer than wide; base usually cuneate to truncate-oblique, less often scarcely cordate; apex acute to bluntly acute; margins coarsely dentate or serrate, having (2–)3–4(–5) teeth per side, less often repand. FLOWERS campanulate, 0.8–1.1 cm long; peduncle 0.7–1 cm long, usually about as long as the flower; calyx 0.5–1.1 cm long, the lobes shorter than the tube; corolla yellow with darkened center, 1.1–1.5 cm wide; anthers yellow, 2–3 cm long. FRUITING CALYX 1.4–2.7 cm long, 1.2–2.5 wide; berry 0.8–2 cm wide; seeds lenticular ca. 1.5 mm wide, the surface rugose. [*P. fendleri* A. Gray, *P. hederifolia* var. *fendleri* (A. Gray) Cronquist, *P. hederifolia* var. *palmeri* (A. Gray) C. L. Hitchc.]. —Canyon bottoms, washes in upland Sonoran Desert, chaparral, and pinyon-juniper woodland; all cos. except Yuma and perhaps La Paz; 500–2100 m (1700–7000 ft); flowering and fruiting Apr–Oct; w N. Amer. and ne U.S.; n Mex.

This widespread and variable species is often confused with *Physalis crassifolia* in AZ. The differences are outlined in the key in lead 8, but occasional intermediates may be found. Whether or not these are hybrids remains to be established. Their habitats and ranges may overlap only slightly: *P. crassifolia* is found in deserts, mainly to the sw of Phoenix and Tucson and the Mojave Desert; *P. hederifolia* is found in chaparral to pinyon-juniper woodlands to the n and e of Phoenix and Tucson. The hairs of *P. hederifolia* vary greatly, being short and retrorse, longer and glandular, or longer and branched. *Physalis crassifolia* has unbranched, erect, short hairs (<0.25 mm) that are usually not glandular. Specimens of *P. hederifolia* with branched hairs have been assigned to *P. fendleri*, or *P. hederifolia* var. *fendleri* but the degree of branching is quite variable; specimens with short glandular hairs have been assigned to *P. hederifolia* var. *palmeri*; we do not believe that these groups warrant formal recognition.

Physalis longifolia Nutt. (long-leaved). —Perennial herb with rhizome, erect to ascending, glabrous to sparsely pubescent on leaf margins, fruits and young growth, the stems up to 80 cm long; hairs mostly appressed, 0.1–0.5 mm long.

LEAVES lanceolate to ± elliptic, 4–11 cm long, 1–4 cm wide, (2–)3–4 times as long as wide; base cuneate, often oblique; apex acute to narrowly acute, or narrowly acuminate; margin entire to repand-sinuate. FLOWERS campanulate, 1.1–1.6 cm long, 1.2–2 cm wide; peduncle 1–1.6(–2.2) cm long, usually equal to or longer than the flower; calyx 0.8–1.2 cm long, the lobes often longer than the tube; corolla cream to greenish-yellow with darkened center; anthers often bluish, 2.5–4 mm long. FRUITING CALYX ovoid, 1.2–3.5 em long, 1–2.8 cm wide; berry 0.6–1.2 cm in diameter; seeds lenticular, 2–2.2 mm wide. [*P. lanceolata* Michx. var. *longifolia* Trel.] —Pine-oak woodland, oak savanna, chaparral, semi-desert grassland, Great Basin scrub, riparian forest and meadows; Apache, Cochise, Coconino, Gila, Pima, Santa Cruz cos.; 700–2600 m (2400–8500ft); Mar–Oct. widespread in N. Amer. from Can. to Mex.

Physalis neomexicana Rydb. (from New Mexico). —Annual herb, erect and unbranched to ascending with spreading branches, the stems up to 44 cm long, densely pubescent, the hairs 0.25–1.2 mm long, obviously multicellular, glandular, spreading. LEAVES elliptic to ovate, 1.1–5.5 cm long, 1–4.9 cm wide, ca. 1.2 times as long as wide; petiole 0.5–5.4 cm long; petiole usually about 2/3 the length of the leaf blade; base rounded, often oblique; apex rounded, obtuse or bluntly acute; margins sinuate to coarsely toothed, the teeth rounded. FLOWERS campanulate, 0.5–0.7 cm long; peduncle 0.5–0.9 cm long; slightly longer than flower; calyx 0.4–0.7 cm long, lobes slightly shorter than or equal to the tube; corolla yellow with darkened center, 0.6–0.7 cm wide; anthers yellow or bluish, 0.1–0.2 cm long. FRUITING CALYX ovoid to subglobose, 1.2–2.4 cm wide, 2–3 cm long; berry 0.7–1.5 cm in diameter; seeds lenticular, 2–2.2 mm wide. [*Physalis subulata* Rydb. var. *neomexicana* (Rydb.) Waterf. ex Kartesz & Gandhi]. —Pinyon-Juniper woodland, interior chaparral, oak woodlands, and riparian areas; s Apache, Coconino, Graham, Greenlee, s Navajo, Yavapai cos.; 1500–2200 m (5100–7000 ft); flowering and fruiting Feb–Mar, Aug–Oct; NM.

Physalis philadelphica Lam. (of Philadelphia). —Annual herb with spreading and ascending stems and branches, sparsely pubescent on leaf edges and veins, more densely pubescent on new growth, the stems up to ca. 45 cm long; hairs up to 1 mm long, not glandular, sometimes clearly multicellular. LEAVES ovate, lanceolate or elliptic, 2–6 cm long, 1–3.4 cm wide, 1.7–2.4 times as long as wide; base acute, often obliquely so; apex acute to acuminate; margins dentate or serrate. FLOWERS campanulate, up to 1.5 cm long; peduncle 0.5–1.2 cm long, usually about 0.5–2 times as long as flower; calyx 0.2–0.6 cm long, the lobes about as long as the tube; corolla yellow, with a purplish darkened center, 0.8–2.2 cm wide; anthers purplish tinged, 3–4 mm long, about as 3–4 times as long as wide, becoming twisted upon drying. FRUITING CALYX ovoid to subglobose, to ca. 2.5 cm long, to ca. 2 cm wide; berry up to 2.5 cm in diameter; seeds lenticular, 2–2.5 mm wide. —Disturbed areas, grasslands; Cochise, Mohave, Pima, Santa Cruz cos.; 1100–1500 m (3600–5000 ft); flowering and fruiting Aug–Sep; widespread in the U.S., Can. and Mex., widely cultivated.

This is the cultivated “tomatillo” from Mexico. It is unclear if populations in Arizona are native or escaped. Cultivated plants should be expected to be more robust than those described here. *Physalis philadelphica* is most similar to *Physalis angulata*. The species are compared in lead 6 of the key.

Physalis pubescens L. (pubescent). —Annual herb, densely pubescent, the hairs 0.25–1.2 mm long, clearly multicellular, glandular. LEAVES ovate (0.9–) 1.5–8.1 cm long, (0.7–) 1.2–8.1 cm wide, 0.6–1 times long as wide; apex acute to acuminate; base slightly cordate to cuneate, often oblique; margins entire to sparsely toothed, the teeth acute. FLOWERS campanulate, 0.5–0.7 cm long; peduncle 0.5–0.9 cm long; calyx 0.4–0.7 cm long; corolla yellow with darkened center, 0.6–0.7 cm wide; anthers yellow or bluish, 0.1–0.2 cm long. FRUITING CALYX ovoid to suglobose 1.7–3.6 cm wide, 2.0–4.0 cm long; berry 0.7–1.7 cm in diameter; seeds lenticular, 1.5–2 mm wide. [*P. latiphysa* Waterf.]. —Forests, canyons, riparian, moist, or disturbed areas, growing with mesquite, cottonwood, oak, and juniper; Cochise, Graham, Pima, Santa Cruz cos.; 1200–2400 m (4000–8000 ft); Feb–Mar, Aug–Oct; NM, w Mex.

Physalis solanaceus (Schltdl.) Axelius (like *Solanum*). —Annual herb, ascending, mainly subglabrous but sparsely to densely strigose on young growth, flowering calyx and peduncles, the stems up to 40 cm long; hairs usually not clearly multicellular, whitish, to ca. 0.5 mm long. LEAVES ovate to ovate-lanceolate, 2.5–7 cm long, 1–3.5 cm wide, 2–2.5 times as long as wide; petiole 1–3 cm long, about 0.5 times as long as blade; base attenuate; apex acute; margins entire to repand. FLOWERS urceolate, 3–5 mm long, 2.5–3.5 mm wide; peduncle 2–3 mm long; calyx ca. 2 mm long, the lobes shorter than the tube; corolla purple or yellow with distinct purple base, 2–3.5 mm wide, the widest point near the middle; anthers purplish, ca. 1 mm long. FRUITING CALYX globose to ovoid, 10–12 mm wide and long; berry 4–7 mm diameter; seeds ca. 2 mm wide. [*Margaranthus solanaceus* Schltdl., *M. lemmoni* A. Gray]. —Canyons, grasslands, desert scrub, woodlands of cottonwood, oak, or pinyon-juniper; Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Santa Cruz, Yavapai cos.; 1000–2000 m (3300–6600 ft); flowering Sep–Aug; NM, n Mex.

Quinula Raf.

Perennial herbs, unarmed, usually trailing-procumbent, sparsely to densely scurfy on young growth, the stems to 35 cm long; hairs subglobose, often deflated and flat in dried specimens, whitish, ca. 0.1 mm long. LEAVES elliptic to obovate, 2–8 cm long, 1–4 cm wide, 1–3.5 times as long as wide; base attenuate, the blade often extending narrowly along the petiole, the petiole occasionally longer than the blade; apex acute to rounded; margins coarsely lobed or toothed or merely sinuate, the lobes or teeth when present 3–5 per side, nearly perpendicular to the margins. INFLORESCENCES uniflorous, appearing axillary. FLOWERS 5-merous, acinomorphic, rotate, erect, 0.7–1 cm long; peduncle 2–4 cm long, usually 2 or more times as long as the flower; calyx 4–7 mm long, the lobes as long as or shorter than the tube; corolla blue to purple, with a whitish center, ca. 2 cm wide; anthers yellow,

ca. 2 mm long. FRUITS berries, surrounded by an inflated persistent calyx, the inflated calyx derived primarily from the tube; fruiting calyx subglobose to ovoid, 1–1.5 cm long and wide; berry 5–6 mm in diameter; seeds yellowish orange, flattened-triangular, ca. 2–3 mm long, the distal edge crenate.—A monotypic genus. (Latin for little five, for spots on the corolla that are sometimes present).

Quincula lobata (Torr.) Raf. (lobed) [*Physalis lobata* Torr.]. —Upland Sonoran desert and desert flats, often with *Prosopis*, often in disturbed places; Apache, Maricopa, Mohave, Pima, Pinal, Yavapai, Yuma cos.; 150–1700 m (450–5600 ft); flowering and fruiting nearly throughout the year but mainly from Mar–May and Sep–Oct; CA to KS, OK, TX; n Mex.

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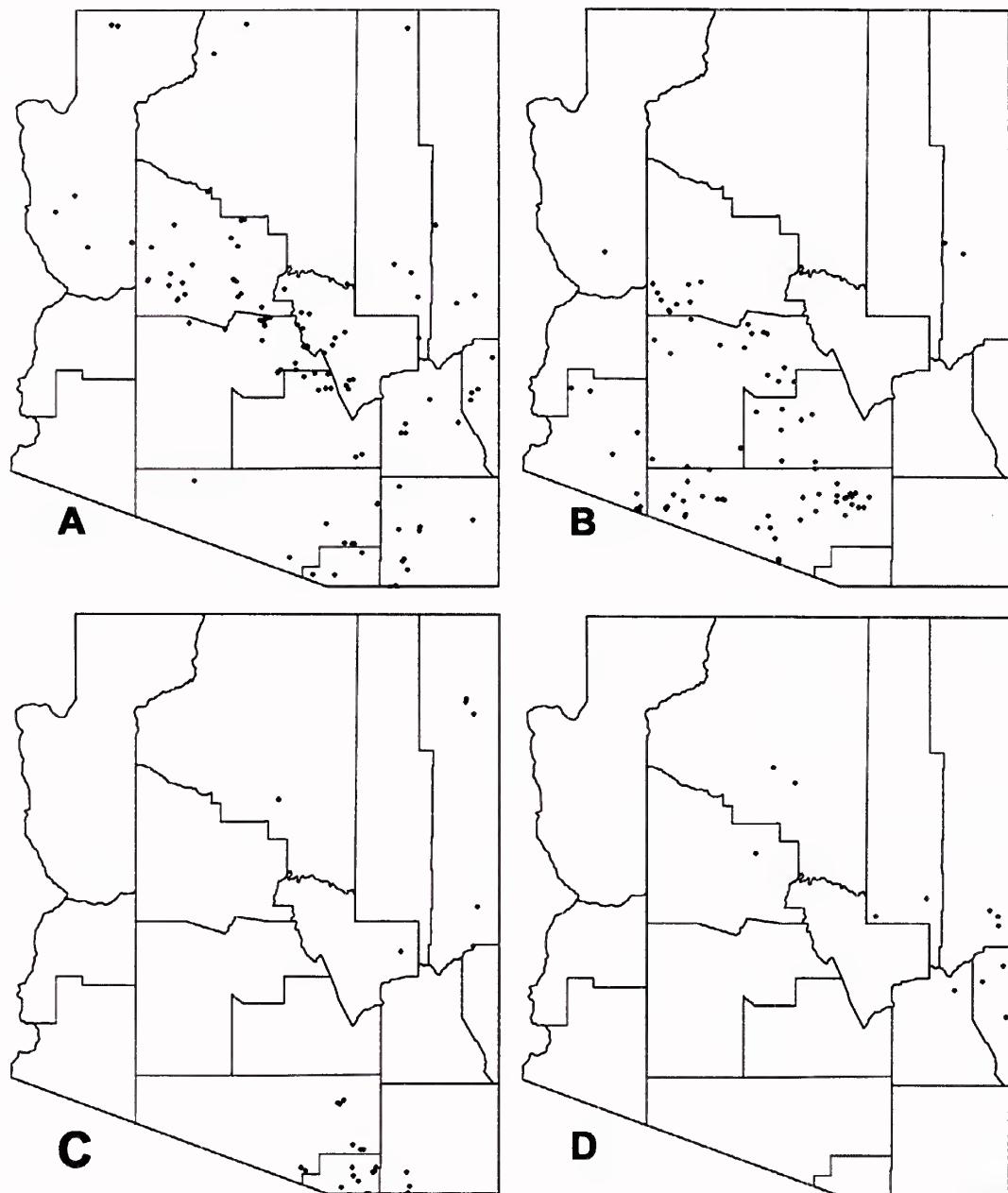
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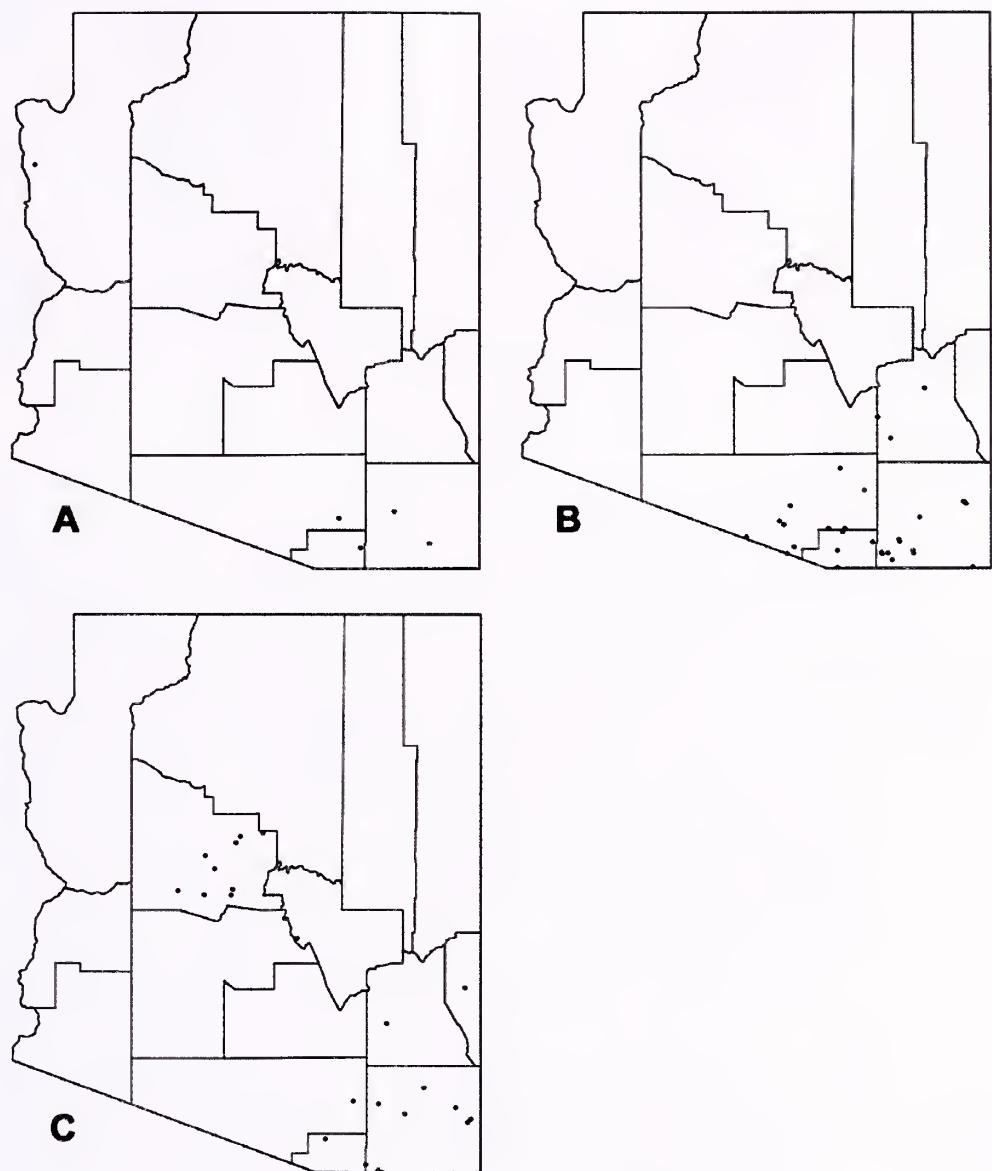
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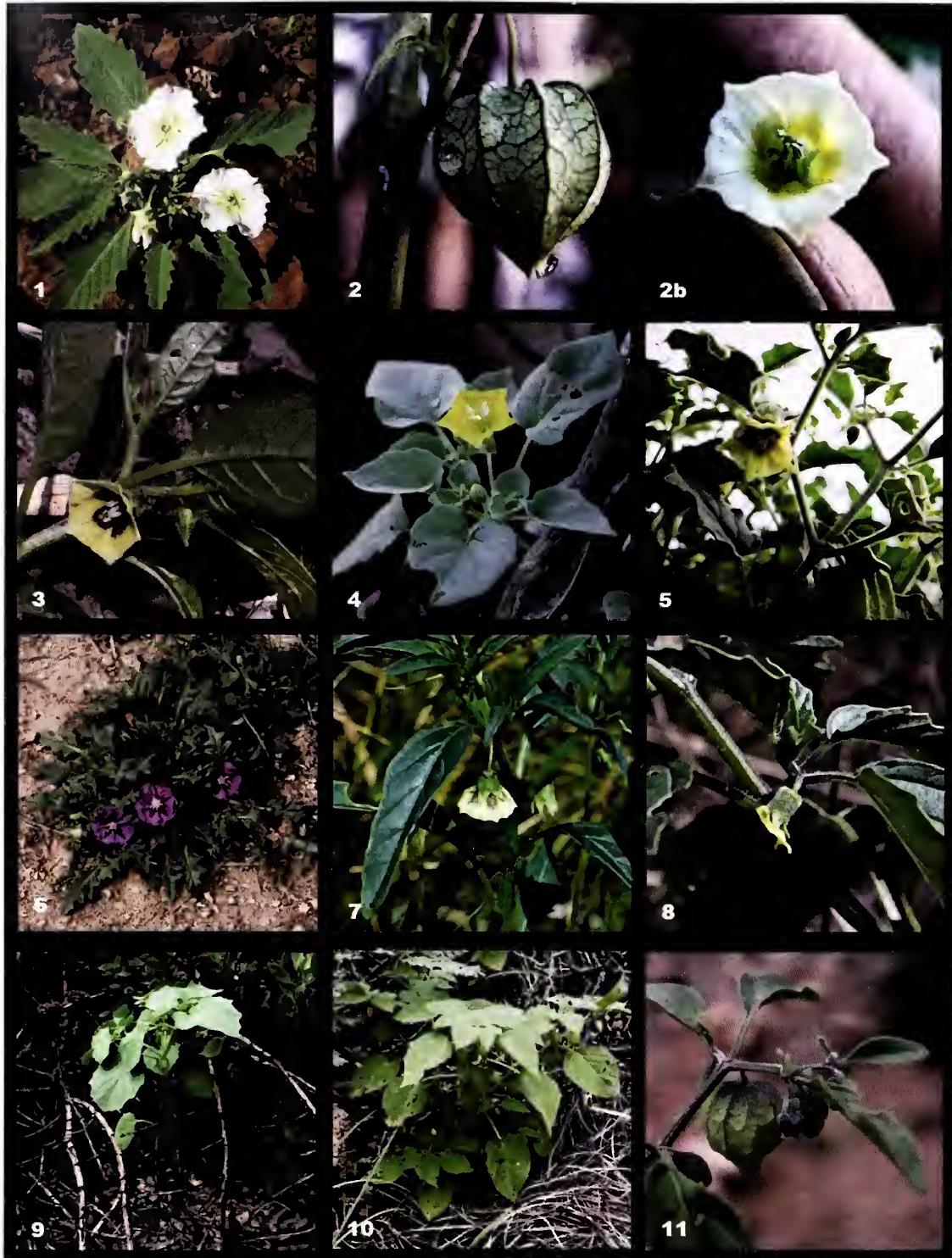
Solanaceae: *Physalis* Figure 1. Distributions of: (A) *Physalis acutifolia*; (B) *Physalis angulata*; (C) *Physalis caudella*; (D) *Physalis crassifolia*.



Solanaceae: *Physalis* Figure 2. Distributions of: (A) *Physalis hederifolia*; (B) *Quincula lobata*; (C) *Physalis longifolia*; (D) *Physalis neomexicana*.



Solanaceae: *Physalis* Figure 3. Distributions of: (A) *Physalis philadelphica*; (B) *Physalis pubescens*; (C) *Physalis solanaceus*.



Solanaceae: *Physalis* Figure 4. Images of: (1) *Physalis acutifolia*; (2) *Physalis angulata*; (3) *Physalis caudella*; (4) *Physalis crassifolia*; (5) *Physalis hederifolia*; (6) *Quincula lobata*; (7) *Physalis longifolia*; (8) *Physalis philadelphica*; (9) *Physalis neomexicana*; (10) *Physalis pubescens*; (11) *Physalis solanacu*s. Photos 1 & 11 by M. Licher; 2, 2b & 10 by L. Landrum; 3 by T. Van Devender; 4 & 6 by P. Alexander; 5 & 9 by F. Coburn; 7 by R. Sivinski; 8 by E. Makings.

SOLANACEAE PART FIVE: *CHAMAESARACHA* (A. GRAY) BENTH. FIVE EYES.

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Perennial herbs, unarmed, the surfaces often hairy, the hairs simple, branched, stellate, or glandular. LEAVES simple, the margins entire to pinnately lobed, subsessile to petiolate. INFLORESCENCES axillary, uniflorous or few-flowered. FLOWERS 5-merous, actinomorphic; calyx campanulate, densely hairy, the lobes triangular, ca. equal to the tube; corolla rotate, creamy yellow to yellow-green, tinged with purple, the throat with white, tomentose, cushion-like pads attached, these alternating with the stamens; stamens equal; anthers free, basifixated, oblong, longitudinally dehiscent, yellow; filaments longer than anthers; stigma minutely 2-lobed. FRUITS spherical berries, tightly invested but only partially hidden by the accrescent calyx (so that top of berry is exposed), the calyx not inflated in fruit; seeds wingless, flattened, reniform. —2 spp. in AZ, 7 spp. worldwide; exclusively of N. Amer., especially the Chihuahuan desert (*chamae*, Greek for “low” or “dwarf” + *Saracha*, a S. Amer. genus of Solanaceae).

1. Surfaces glabrous to scurfy, the hairs short, white, branched or stellate, often mixed with longer, tangled hairs, never glandular; leaves subentire to deeply lobed.....*C. coronopus*
- 1' Surfaces densely covered with glandular hairs mixed with longer, simple hairs; leaves entire to only slightly lobed.*C. sordida*

***Chamaesaracha coronopus* (Dunal) A. Gray** (Greek: *korone* = crown + *pous* = foot). Greenleaf five eyes. —Herbs, to 50 cm tall, rhizomatous, glabrous to scurfy, the hairs short, white, branched or stellate, often mixed with longer, tangled hairs (especially on stems, peduncles, and calices). LEAVES linear, lanceolate, narrowly elliptic, or oblanceolate, 1.5–8 cm long, the margins minutely undulate to pinnately lobed and often densely hairy, membranous to subcoriaceous, the midvein prominent; apex acute to rounded-obtuse, tapering to an attenuate, subsessile base. INFLORESCENCES uniflorous, the peduncles 1–3 cm long. FLOWERS with calyx 2.5–6.0 mm long, densely stellate-pubescent; corolla ca. 1 cm wide, the white cushion-like pads contiguous (or nearly so) and almost filling the throat; stamens less than 6 mm long; anthers ca. 1/3 as long as filaments. FRUITS 4–8 mm wide, whitish, pendulous; seeds light brown, alveolate. —Weedy, found especially in disturbed areas, dry grasslands, and deserts; all cos. except La Paz (Fig. 1D); 200–2100 m (700–6900 ft); Mar–Oct; sw U.S. and n Mex.

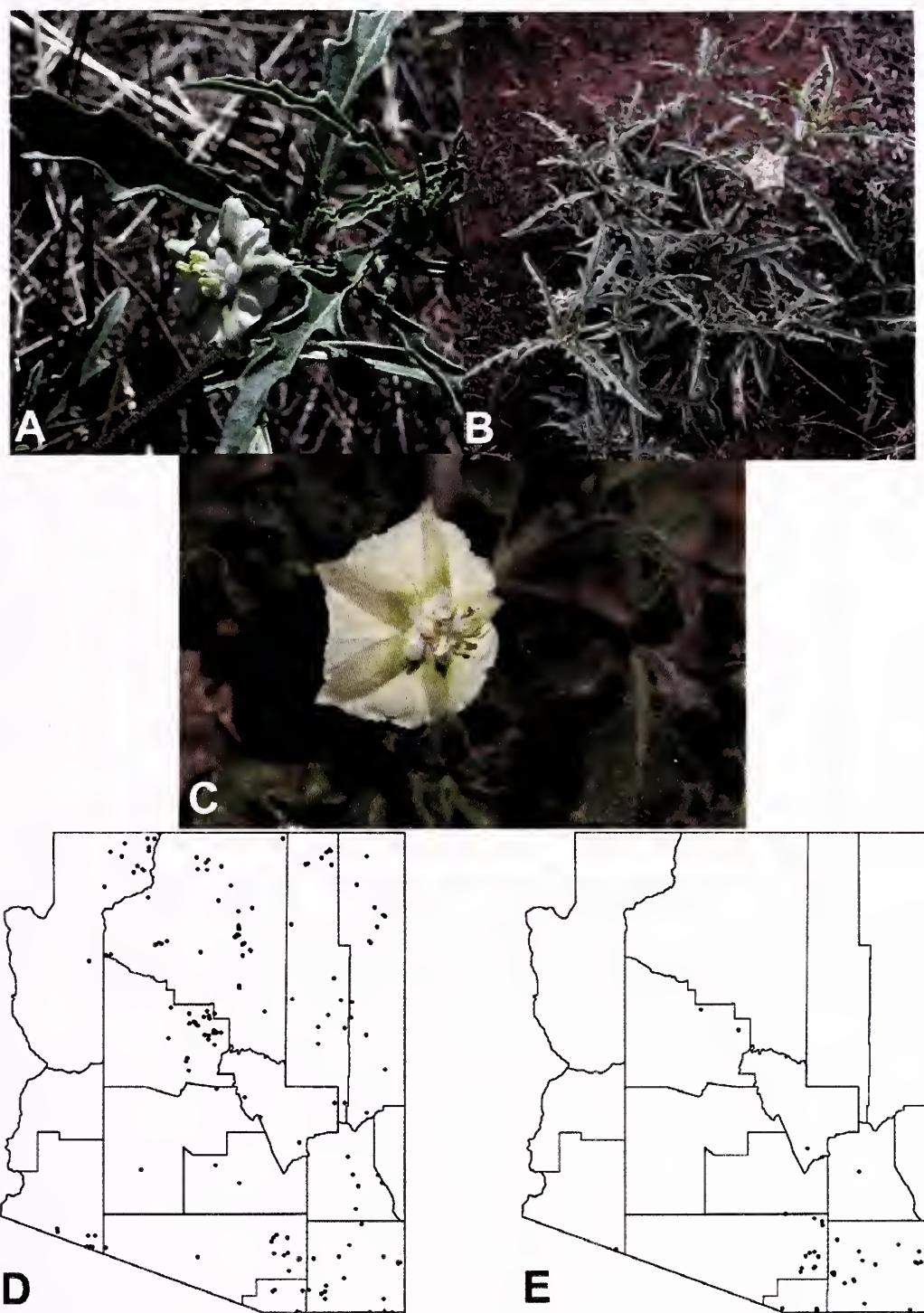
***Chamaesaracha sordida* (Dunal) A. Gray** (dull, dirty). Hairy five eyes. — Herbs, to 30 cm tall, rhizomatous, densely glandular-pubescent, the glandular hairs mixed with longer, simple hairs (especially on the stems, peduncles, and calices). LEAVES lanceolate, elliptic, oblanceolate, or rhombic, 1–4 cm long, the margins mostly entire or subentire, sometimes shallowly lobed or toothed, membranous to subcoriaceous; apex acute to rounded, tapering to an attenuate, subsessile base. INFLORESCENCES uniflorous, the peduncles 1–3 cm long. FLOWERS with calyx 3–5 mm long, densely glandular-pubescent; corolla ca. 1 cm wide or less, the white cushion-like pads not contiguous and not filling the throat; stamens less than 6 mm long; anthers 1/2–1/3 as long as filaments. FRUITS 4–8 mm wide, whitish, pendulous; seeds light brown, alveolate. —Found in disturbed areas and deserts; Cochise, Gila, Graham, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos. (Fig. 1E); 700–1700 m (2300–5600 ft); Mar–Oct; sw U.S. and n Mex.

Chamaesaracha sordida was merged into the closely related *C. conoides* by Gray (1876); however, the two taxa are now distinguished by morphological, chemical, and chromosomal differences (Averett 1973). Although the distributions of the two species overlap in some states, apparently *C. conoides* does not extend westward into AZ.

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Chamaesaracha Figure 1. Flowers and distribution maps for *Chamaesaracha*. (A, B, D) *Chamaesaracha coronopus*; (C, E) *Chamaesaracha sordida*. (Photos A & B by Max Licher and C by Patrick Alexander).

**THAMNOSMA TEXANA, A CHIHUAHUA DESERT SPECIES, DISJUNCT IN
THE HUALAPAI MOUNTAINS, MOHAVE COUNTY, ARIZONA.**

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The discovery of *Thamnosma texana* (A. Gray) Torr. in the Hualapai Mountains of Mohave County, Arizona is notable because it extends the known range of the species by over 100 kms. It is also of interest because the plant was first identified by recognizing the insects that use it as a host and because the new record seems to be an exception to the general rule that populations of *Thamnosma texana* disjunct from the Chihuahuan Desert tend to grow in locally atypical habitats.

Identification of plants in the field is primarily based on morphological characters; but, geographic range is also an important identification tool. Plant species typically occur as part of a floristic province (McLaughlin 2007). These floristic provinces, each with its own geographic range, are defined by their unique species compositions. When populations of a plant species are discovered in distant and different geographic provinces, outside their normal range, identification can be problematic. Since the usual range and floristic parameters for identification do not apply, other factors can be used to make an identification.

An instance of this is presented here from the Hualapai Mountains, Mohave County, AZ (35.065946 N 113.784616 W). In November 2011, Francois, an entomologist by training, found an unfamiliar plant species (Fig. 1A) during environmental assessment work. However, there was a familiar butterfly larva present on the plant. She identified it as the 5th instar larva (Fig. 1B) of the black swallowtail butterfly (*Papilio polyxenes*) (Fig. 1C). From a quick literature review (Finke and Scriber 1988, Drees and Jackman 1998), she found a list of the host plant species of this butterfly larva. This list (and the plant's particular odor) narrowed the options for identification. After that, based on the butterfly larva's host plant preferences and the plant's morphology, Francois identified the plant as *Thamnosma texana* (A. Gray) Torr. Anderson, previously familiar with *Thamnosma texana* (1996), subsequently visited the Hualapai Mountain site, confirmed the plant identification as *Thamnosma texana* (Fig. 1A) and collected vouchered specimens

(Anderson 2011-56, ASU) and habitat data. Approximately twenty-five plants were counted. This population of *Thamnosma texana* is the first record for the Hualapai Mountains and is a range disjunction from its known range and floristic province, the Chihuahuan Desert of Mexico, Texas, New Mexico, and southeast Arizona. It is approximately 130 kilometers disjunct northwest from the nearest population in the Upper Verde River area near the Chino Valley (Coburn 536, ASU) and 400 kilometers disjunct from its typical range in southeast Arizona.

Many plant species that are widely disjunct from their normal range and habitat are able to survive on locally anomalous habitats in regions where the more common vegetation type would outcompete them. These anomalous habits may differ edaphically or topographically from the more common habitats (Gakin and Major 1964, Kruckeberg 1969), and may function as refugia by providing an environmental dissimilarity to which the locally dominant species are poorly adapted and do not occur. Thus, an ecological island is left open sometimes allowing several disjuncts (even of different floristic origins) to occur together by taking advantage of atypical habitat conditions with less local plant competition. In the Sonoran Desert of central Arizona many examples of such disjunctions have been documented on late Tertiary lacustrine deposits (Anderson 1996, 2012) which provide an anomalous edaphic habitat contrasting with the surrounding igneous derived habitats. *Thamnosma texana* follows this disjunct pattern (Fig. 1E) and has been documented on late Tertiary lacustrine deposits (Anderson 1996) at the Lower Verde River near Horseshoe Reservoir (Anderson 87-21, ASU) and in the Verde Valley (Lehto 21344, ASU) as well as on the Martin Formation, a Paleozoic marine limestone at the Upper Verde River Canyon near the Chino Valley, Yavapai County (Coburn 536, ASU). It is usually a Chihuahuan Desert species that ranges from northern Mexico through west Texas, southern New Mexico and into southeastern Arizona in Cochise County and eastern Pima Counties. An examination of label data in SEINet (2012) shows that it is primarily a desert species (43 out of 67 collections) growing on limestone (51 out of 78 collections). It also occurs to a lesser degree in semi-desert grassland, interior chaparral and pinyon-juniper-oak woodlands on rocky slopes and along washes. The habitat of the disjunct populations in central Arizona mimics its usual limestone habitat in the Chihuahuan desert (SEINet 2012).

The late Tertiary lacustrine deposit at Burro Creek on the Mohave/Yavapai County line lies in between the Verde Valley and the Hualapai Mountains. Despite much field work there *Thamnosma texana* had not been found (Anderson 1996, 2012). The discovery of *Thamnosma texana* farther to the northwest in the Hualapai Mountains raised the possibility that it might occur at the geographically intermediate Burro Creek lacustrine locality and had been overlooked. Anderson searched there again in December 2012, especially under the *Quercus turbinella* shrubs, without success.

The Hualapai Mountains population of *Thamnosma texana* does not follow the disjunct pattern of occurrence within an anomalous habitat as described above. Here, *Thamnosma texana* grows within the locally common habitat (Fig. 1D) of granitic hills at 1310 m with a mix of common Interior Chaparral and semi-desert grassland plant species (Brown 1982), rather than lacustrine limestone Sonoran Desert habitat similar to the disjunct populations in the Verde Valley and lower Verde

Valley (Anderson 1996). In the Hualapai Mountains it is usually found growing next to or under *Quercus turbinella* Greene. Other associated species are *Aloysia wrightii* A. Heller, *Aristida purpurea* Nutt., *Baccharis brachyphylla* A. Gray, *Berberis haematocarpa* Woot., *Bouteloua curtipendula* (Michx.) Torr., *B. eriopoda* (Torr.) Torr., *Canotia holacantha* Torr., *Cylindropuntia acanthocarpa* (Engelm. & Bigelow) F. M. Knuth, *Echinocereus engelmannii* (Parry) Lemaire, *Eragrostis intermedia* Hitchc., *Ericameria laricifolia* (Gray) Shinners, *Eriogonum inflatum* Torr. & Frem., *Hilaria rigida* (Thurb.) Benth. ex Scribn., *Krameria erecta* Willd. ex Schult., *Lotus rigidus* (Benth.) Greene, *Melampodium leucanthum* Torr. & Gray, *Opuntia chlorotica* Engelm. & J. M. Bigelow., *O. phaeacantha* Engelm., *Pappostipa speciosa* (Trin. & Rupr.) Romasch, *Psilostrophe cooperi* (Gray) Greene, *Scutellaria mexicana* (Torr.) A. J. Paton, *Senegalia greggii* (A. Gray) Britton & Rose, *Stephanomeria pauciflora* (Torr.) A. Nels., and *Yucca baccata* Torr.

The occurrence of *Thamnosma texana* in the Hualapai Mountains is surprising, both for its wide disjunction and for its presence in a common habitat. However, it is not alone in its disjunction from a typical range in southeastern Arizona onto a common habitat in the Hualapai Mountains. Two other species have similar distributions. *Sophora arizonica* S. Wats. [*Dermatophyllum arizonicum* (S. Wats.) Vincent] is a disjunct species from southeastern Arizona, found in the eastern foothills of the Hualapai Mountains (Fig. 1E). It is an Arizona endemic whose nearest relative, *Sophora gypsophila* B. L. Turner and J. M. Powell, occurs in west Texas within the known range of *Thamnosma texana*. In southeastern Arizona the two occur together in the Swisshelm (McManus 572, ARIZ) and Whetstone Mountains (McLaughlin 190, 219, ARIZ). *Parthenium incanum* H. B. K. is another predominantly limestone species from the Chihuahuan Desert with a parallel range to *Thamnosma texana*. At the western edge of its range in the Hualapai Mountains (Anderson 95-25, ASU) and the Cerbat Mountains (Anderson 94-18, ASU), it occurs on a common granitic hills habitat or other volcanic substrates, rather than limestone. However, its range in Arizona is more continuous, rather than disjunct, and extends to northwest Arizona. This co-occurrence of other Chihuahuan Desert species in the Hualapai Mountains may provide clues of an older biogeographical pattern and evidence of the past vegetative history of the region.

ACKNOWLEDGMENTS

We thank Rebecca Peck and Ammon Wilhelm from the BLM Kingman Field Office for field assistance. Much appreciation is extended to Samuel Jaffe for the use of the black swallowtail butterfly larva picture and Tom Murray for the use of the black swallowtail adult pictures. Liz Makings at ASU provided valuable assistance preparing figures, making plant distribution maps and reviewing the manuscript.

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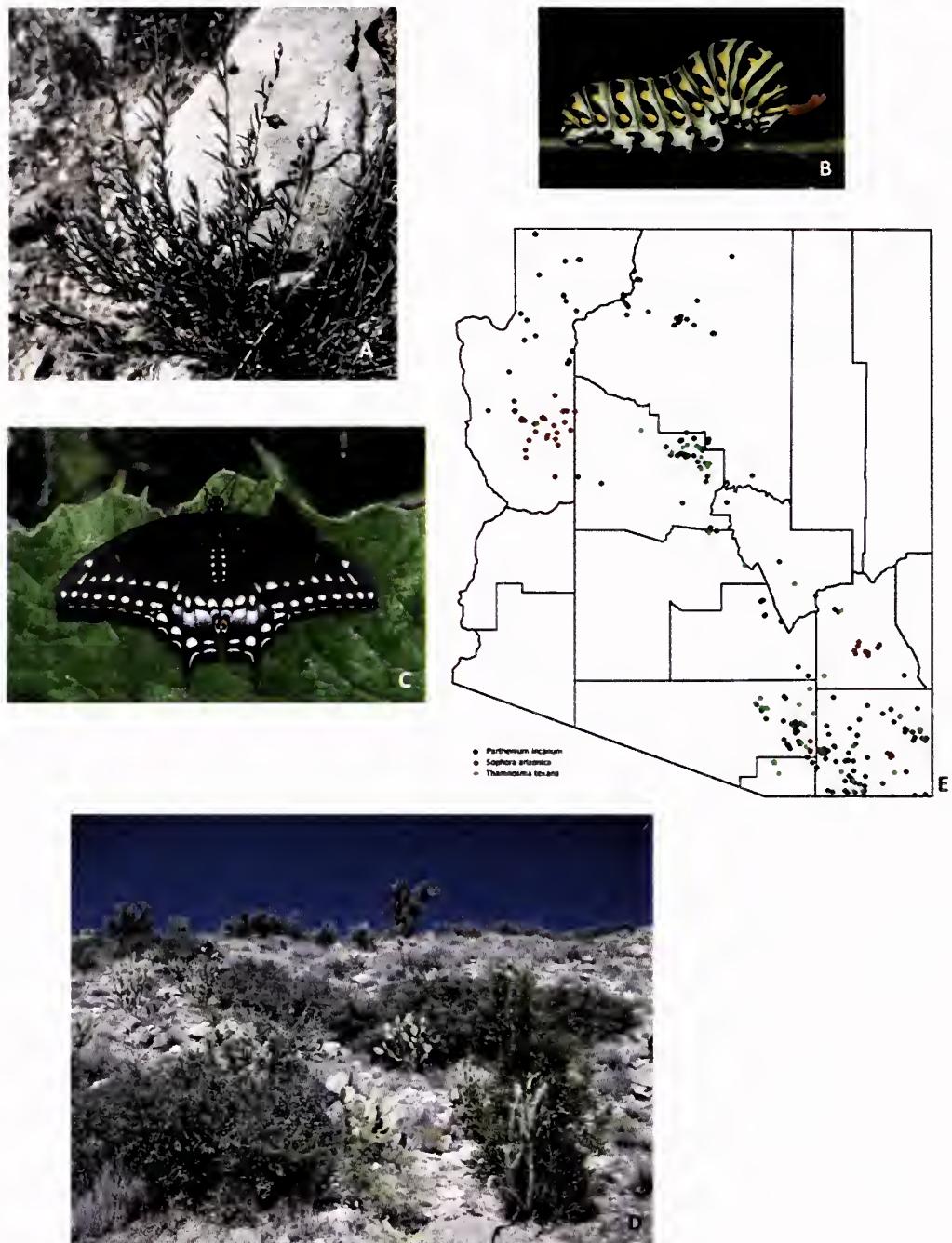


Figure 1. A. *Thamnosma texana* in Hualapai Mountains. B. Fifth instar larva of *Papilio polyxenes*, black swallowtail butterfly (photo by S. Jaffe). C. Adult female of *Papilio polyxenes* (photo by T. Murray). D. Granitic hills habitat of *Thamnosma texana* with interior chaparral and semi-desert grassland species. Glaucous green shrubs are *Quercus turbinella*. E. Map of *Thamnosma texana* (green dots), *Sophora arizonica* (red dots), and *Parthenium incanum* (black dots) in Arizona.

A VASCULAR PLANT INVENTORY OF THE SPUR CROSS RANCH CONSERVATION AREA, MARICOPA COUNTY, ARIZONA

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ABSTRACT

A vascular plant inventory of the Spur Cross Ranch Conservation Area was conducted from August 2007 through May 2012. The study site, encompassing 2,154 acres (871 hectares), lies close to the northern edge of the Sonoran Desert, in central Arizona. The elevation ranges from Cave Creek at 2,179 feet (664 meters) to the summit of Elephant Mountain at 3,926 feet (1,197 meters). Sonoran Desertscrub is the dominant vegetation type. An annotated checklist, based on collected plant specimens, comprised 396 taxa, including 390 species, 4 additional infraspecific taxa and 2 interspecific hybrids in 73 plant families. Asteraceae, Poaceae, Fabaceae, Boraginaceae and Brassicaceae accounted for 44% of the species included in the inventory. Non-native taxa accounted for 15% of the flora. One rare species of concern, one new state record, and seven species endemic to Arizona are reported. This inventory documents the current floristic diversity of a regionally significant Conservation Area and provides baseline data for future studies of shifts in diversity and use in land management.

INTRODUCTION

The Spur Cross Ranch Conservation Area (SCRCA) is situated close to the northern edge of the Sonoran Desert, in central Arizona, on the northeastern margin of the Phoenix metropolitan area. It is part of a complex of 10 regional parks that rings the city of Phoenix, managed by the Maricopa County Parks and Recreation Department. The newest addition to the Parks system, the SCRCA was created in 2001, and is the only part of the complex designated a Conservation Area (Maricopa County Parks 2013, Gunn, pers. comm. 2009).

The rugged terrain is composed of Elephant Mountain, hills, low mesas, drainages and approximately 2 mi (3 km) of Cave Creek. There are 12 mi (19 km) of trails for hiking, some of which are also available for bicycling and horseback riding. The area also has a number of prehistoric and historic archaeological sites.

This land has been set aside, in part, for protection of its natural resources (URS Corp. 2004), so knowledge of species occurrences is important. The main objective of this study is to document the vascular flora of the SCRCA with an annotated checklist and voucher specimens. These baseline data are necessary for future comparisons of floristic diversity and other research relying on plant species of the area. The flora is also intended to be useful for land managers, educational purposes, and anyone interested in the plants of the region. Nearly all of the Maricopa County parks have been floristically inventoried, however few plant collections and no comprehensive inventory of vascular plants have been made in the SCRCA prior to this study.

STUDY AREA

Area boundaries—The SCRCA is located north of the Town of Cave Creek, in northern Maricopa County (Fig. 1). It is approximately 32 mi (51 km) northeast of downtown Phoenix. It is bounded by $33^{\circ}54.000'$, $33^{\circ}52.735'$ north latitudes and $111^{\circ}59.641'$, $111^{\circ}56.451'$ west longitudes, and covers an area of 2,154 acres (871 ha). The Tonto National Forest forms the northern boundary. Arizona State Trust Land borders the west and part of the south side and a mix of private, Town of Cave Creek, and unincorporated Maricopa County land borders the east and part of the south side. Desert Foothills Land Trust owns 26.6 acres (10.8 ha) of land (Jewel of the Creek Preserve) along Cave Creek within the reach running through the SCRCA (Desert Foothills Land Trust 2013).

Topography—The SCRCA lies in the southwest corner of the USGS New River Mesa 7.5 minute series topographic Quadrangle. The elevation of the SCRCA ranges from the bed of Cave Creek at 2,179 ft (664 m) to the summit of Elephant Mountain at 3,926 ft (1,197 m). Elephant Mountain dominates the west side of the Conservation Area. Its top is a long ridge, resembling an elephant's head and back. The terrain east of Elephant Mountain consists of hills and low mesas dissected by several ephemeral drainages that empty into Cave Creek. The creek originates about 12 mi (19 km) to the north, in the Tonto National Forest, flows southwest through the SCRCA and ends at Cave Buttes Dam, about 12 mi (19 km) southwest of the Conservation Area, in Phoenix. The reach flowing through the SCRCA is mainly intermittent, generally flowing in the winter to spring months and during summer monsoon storms (Fig. 3A). Jewel of the Creek Preserve contains a perennial reach that continues a short distance into the SCRCA. Cottonwood Creek, an ephemeral drainage, is a large tributary of Cave Creek, in the eastern section of the SCRCA.

Geology—Arizona is characterized by two major physiographic provinces: the Colorado Plateau to the north, and the Basin and Range to the south. A mountainous Transition Zone (also known as the Central Arizona Highlands) divides the two (Nations & Stump 1996). The Conservation Area is located on the southern edge of the Transition Zone, bordering the Basin and Range province. Ferguson, Gilbert and Leighty (1998) mapped and described the geology of the USGS New River Mesa Quadrangle. Their study indicates that the majority of rocks within the SCRCA are from the Quaternary and Mid-Tertiary periods, with Early Proterozoic rocks making up the remainder. The Early Proterozoic rocks are largely fine-grained quartz monzonite, found along the northern and eastern parts of the conservation area as well as along Cave Creek and Cottonwood Creek. Metamorphosed basalt and felsic intrusive sill sills are also visible along the creeks. The Mid-Tertiary rocks are mainly volcanic in origin. A sequence of basaltic lavas and tuffs interbedded with sedimentary rocks is exposed in small patches and bands throughout the study area. Overlying this is a series of basalt lava flows, mainly in the western half of the SCRCA, which cover the top of Elephant Mountain and portions of its slopes. Finally, the youngest rocks (Quaternary) consist of talus and colluvial slope deposits, mainly on Elephant Mountain, and alluvial sediments on vegetated terraces and along active channels such as Cave Creek (Ferguson et al. 1998).

Climate—The region has a semi-arid climate, experiencing moderate to high temperatures. Most of the precipitation falls in the summer and winter months. Summer monsoons are localized, often intense storms, while winter rains tend to be more widespread and gentle (Dimmitt 2000). Precipitation records cited here were measured by the Flood Control District of Maricopa County at the Cave Creek@Spur Cross #4920 rain gauge. The annual mean precipitation from 2007-2012 was 11.05 in (28.07 cm). The driest and wettest years were 2007 (9.09 in/23.09 cm) and 2010 (13.46 in/34.19 cm). Monthly extremes ranged from no measurable precipitation during many months to 6.26 in (15.90 cm) in January, 2010 (FCDMC 2013). Snowfall is an occasional event rarely producing accumulation.

The nearest temperature gauge is in the adjacent town of Carefree, approximately 8 mi (13 km) east of the SCRCA. Temperatures recorded from 1962-2012 range from an average maximum of 102.0°F (38.9°C) in July to an average minimum of 40.5°F (4.7 °C) in December (WRCC 2013). Extremes during the study were 108°F (42 °C) in July and/or August of 2007, 2011 and 2012, and 19°F (-7 °C) in January 2011 (FCDMC 2013).

Cultural History—Archaeological sites on the SCRCA are numerous and the preservation of these was one of the motivations for public acquisition of the property (URS Corp. 2004). Several surveys and limited excavations have been conducted on the SCRCA since the 1970s, with much of the work being initiated by development companies (Holiday 1974, Redman & Minnis 1992, and Crary & Motsinger 1996). The majority of the sites are prehistoric and include rock-walled rooms, pit houses, a fortified hilltop, a wide range of artifacts, and petroglyphs. The earliest human occupants appear to be from the early Formative Period (A.D. 1-700) (Crary & Motsinger 1996, Minnis 1992a). However, most of the prehistoric occupation sites date from the Classic Period (A.D. 1150-1450) of the Hohokam tradition (Crary & Motsinger 1996, Minnis 1992b, Swidler 1992, Wood, pers. comm. 2010).

After a period of abandonment, the next people to use the area were likely Apache, from the late 1600s into the mid-late 1800s, and then the Yavapai, who occupied the area toward the end of the Apache presence (Wood, pers. comm. 2013). The arrival of the Apache and Yavapai into central Arizona is poorly documented in the archaeological record, but there is some evidence that Protohistoric period components exist on the SCRCA (Crary & Motsinger 1996).

With the arrival of Euro-Americans, and the discovery of gold in Arizona, in the 1860s, conflict arose between the newcomers and the Apache. The U.S. army set up military forts and eventually defeated the Apache, which led to an era of mining, ranching and farming (Gregory 1992). Several mines were operated on the SCRCA, including the Maricopa and Phoenix mines (Carlson 1988). Today the remains of both mines include shafts, tunnels, tailings, and traces of mining equipment.

Spur Cross Ranch, established in 1928, was named for its cattle brand, a cross-shaped spur. The first dude ranch in the area, it later operated as an authentic ranch and ownership changed a number of times. Several building foundations and a well are evidence of existence of the ranch (Carlson 1988). The property was mainly owned by development companies from the late 1980s into the 1990s. In 1997 the Town of Cave Creek annexed the land to protect it from development proposals, and in 2000, residents of the town voted to tax themselves to help purchase the property.

In 2001 it was designated a Conservation Area through a partnership of the State of Arizona, the Town of Cave Creek and Maricopa County (Gunn, pers. comm. 2009).

Vegetation—The vegetation of the SCRCA is a relatively dense scrubland composed of small trees, shrubs, and cacti, which display myriad shades of green. It is characterized by Turner (1994) as Arizona Upland, a subdivision of Sonoran Desertsrub (Fig. 2A). This plant community receives the most rain of any desertsrub in North America. The most common association in the SCRCA is Paloverde-Cacti-Mixed Scrub, dominated by the green-barked tree, *Parkinsonia microphylla* (foothill paloverde). Also abundant is the columnar cactus, *Carnegiea gigantea* (saguaro). Individuals of this species are the tallest plants in this habitat, punctuating the landscape like exclamation points. Other common plants include *Olneya tesota* (desert ironwood), *Ambrosia deltoidea* (triangle bur ragweed), *Encelia farinosa* (brittlebush) (Fig. 3B), *Simmondsia chinensis* (jojoba), *Opuntia engelmannii* (Engelmann prickly pear), and *Cylindropuntia acanthocarpa* (buckhorn cholla). *Larrea tridentata* (creosote bush), *Fouquieria splendens* (ocotillo), and *Cylindropuntia bigelovii* (teddybear cholla) are often found in localized populations.

Riparian habitats occur along Cave Creek, larger ephemeral drainages such as Cottonwood Creek, and in pockets around a couple of seeps near the base of Elephant Mountain (Fig. 2B). The *Salix gooddingii* (Goodding's willow)-*Populus fremontii* (Fremont cottonwood) association (Stromberg 1993) forms a narrow strip of forest along the perennial reach of Cave Creek. The cottonwoods are the tallest trees here, though few in numbers. *Salix gooddingii* is abundant with *Fraxinus velutina* (velvet ash) being the next most numerous tree. Other streamside trees include *Prosopis velutina* (velvet mesquite), *Platanus wrightii* (Arizona sycamore), and *Juglans major* (Arizona walnut). *Typha domingensis* (southern cattail) and *Schoenoplectus pungens* (common threesquare) are found in the understory, usually in pure stands.

On the floodplains of Cave Creek and Cottonwood Creek, *Prosopis velutina* (velvet mesquite), *Celtis pallida* (desert hackberry), and *Acacia greggii* (catclaw acacia) dominate, *Lycium exsertum* (wolfberry) is common, and *Ambrosia monogyra* (singlewhorl burrobush) and *A. ambrosioides* (canyon ragweed) grow almost exclusively in this habitat. On both creeks, where *Prosopis velutina* is thickest, it forms a mesquite bosque (mesquite woodland) (Fig. 2C; Minckley & Brown 1994). A small pond, within the bosque near the Metate Trail, is fed by a solar-powered well and serves as a refuge for the endangered, native desert pupfish and Gila topminnow (Yarush et al. 2012).

On the north face of Elephant Mountain, the Sonoran Desertsrub Arizona Upland vegetation begins to intergrade with Interior Chaparral, as described by Abel (1980), and elements of Semi-Desert Grassland appear as well (Fig. 2D; Brown 1994). The upper slopes are dominated by shrubs, and saguaros are notably absent. Indicative of Interior Chaparral species are *Ceanothus vestitus* (desert ceanothus), *Cercocarpus montanus* (birchleaf mountain mahogany), *Juniperus arizonica* (redberry juniper), *Quercus turbinella* (Sonoran scrub oak), and *Rhus ovata* (sugar sumac), all of which are infrequent to rare. Common species include *Canotia holacantha* (crucifixion thorn), *Ericameria laricifolia* (turpentine bush), *Eriogonum fasciculatum* (flat-top buckwheat), *Hilaria mutica* (tobosagrass), *Opuntia engelmannii* (Engelmann prickly pear), *Pappostipa speciosa* (desert needle grass),

Simmondsia chinensis (jojoba), and *Yucca baccata* (banana yucca), and most of these can be found in at least two of the three habitats mentioned.

Fire and livestock grazing have not impacted the vegetation in at least the last 10 years. The Cave Creek Complex Fire in 2005 came within a few miles of the SCRCA boundary and a 3 acre (1.2 ha) burn occurred in the Jewel of the Creek Preserve in 2009.

METHODS

Plant collecting trips were made throughout all seasons from August 2007 through May 2012 and specimen vouchers were prepared for every taxon. Sampling was most intensive after winter and monsoon rains and in 2008, when new taxa were found in every month. Collections were made in all vegetation and substrate types, and a representative range of slope aspects and elevations. Data recorded for each collection included coordinates and elevation using a GPS unit, locality and plant description, habitat type, associated species and relative abundance. Photos were taken of nearly all taxa in the field.

Five species (*Amaranthus fimbriatus*, *Arundo donax*, *Cenchrus ciliaris*, *Salix laevigata*, and *Zeltnera nudicaulis*) collected within 1/4 mile (~1/2 km) of the Conservation Area boundary upstream were included in the study due to the fact that they had the potential to be found further downstream, within the SCRCA, in the future. *Cenchrus ciliaris* (buffelgrass) was also found within the SCRCA, but was removed prior to the inventory. Jewel of the Creek Preserve was scouted throughout the study but no species were added to the inventory.

The voucher specimens, which provide verification of the inventory as well as reference material, were deposited at the Desert Botanical Garden herbarium (DES) in Phoenix. Duplicate vouchers, when available, were deposited at the University of Arizona herbarium (ARIZ) in Tucson. One duplicate of *Malacothamnus fasciculatus* was sent to the Illinois Natural History Survey (ILLS) in Champaign, Illinois for verification. Specimens were identified using *Arizona Flora* (Kearney et al. 1960), *Flora of North America* (Flora of North America Editorial Committee 1993+), treatments published in *Journal of the Arizona-Nevada Academy of Science* and *Canotia* (Vascular Plants of Arizona Editorial committee 1992+), and herbarium material at DES, ASU (Arizona State University herbarium), or ARIZ. On a few occasions other sources such as the *Jepson Manual* (Hickman, ed. 1993) and experts in particular plant groups were consulted as well.

RESULTS AND DISCUSSION

Fieldwork produced 550 collections during 101 collecting trips. A total of 394 distinct taxa were determined, including 388 species, 4 additional infraspecific taxa and 2 interspecific hybrids. A herbarium search, using the databases in SEINet (2013), revealed two additional species, *Rhus lancea* (Makings 3876, ASU), and *Arundo donax* (Makings 3862, ASU), bringing the total species to 390 and the total taxa to 396. These represent 268 genera in 73 families (Table 1). The five largest families by species, Asteraceae (62), Poaceae (46), Fabaceae (26), Boraginaceae (19),

and Brassicaceae (15), make up 44% of the flora (Table 3), while 29 families are represented by a single taxon. *Euphorbia* and *Eriogonum* are the two largest genera with 8 and 6 species, respectively. Nearly half (48%) of the taxa are ephemerals (Fig. 3D) and together with perennial herbs they compose 75% of the total taxa. Trees, shrubs/subshrubs and succulents account for the remaining 25% (Table 2).

Although 2005 (prior to this study) produced one of the more dramatic and diverse displays of ephemerals in recent time, 2008 was also very good, and as a result approximately three quarters of the taxa were documented in that year. Nearly 20% of the flora was found from 2009 through 2012, with the number decreasing each year.

The majority of the taxa (337) are native to North America (USDA 2013), making up 85% of the flora. Of the 15% (59) that are non-native, Poaceae (19) is best represented, followed by Asteraceae (8), Amaranthaceae (5), and Brassicaceae (5). Ephemerals are the most common life form of these non-native taxa. Three non-native species likely to have been planted are *Aloe maculata* (surviving for years near a former squatter's camp but no longer present), *Cannabis sativa* (removed) and *Tamarix aphylla* (a small grove of tall trees).

SCRCA species listed as noxious weeds in Arizona (USDA 2013) are *Cenchrus ciliaris*, *Cuscuta* spp. (the species in this flora is native), *Medicago polymorpha*, *Portulaca oleracea*, and *Tribulus terrestris*. These range from occasional to rare in the study area. Many more species appear on the Arizona Wildlands Invasive Plant Working Group list (AWIPWG 2013). Those considered to be of high concern are *Arundo donax*, *Bromus rubens*, *Eragrostis lehmanniana*, *Cenchrus ciliaris*, *C. setaceus*, and *Tamarix chinensis*. *Bromus rubens*, a major concern for fire, is common and the others are occasional to rare.

Eleven species (*Juncus xiphiooides*, *Lythrum californicum*, *Mimulus guttatus*, *Nasturtium officinale*, *Schoenoplectus pungens*, *Stemodia durantifolia*, *Synphytum subulatum* var. *parviflorum*, *Veronica americana*, *V. anagallis-aquatica*, *V. peregrina*, and *Typha domingensis*) are rated as obligate wetland species according to the newly revised National Wetland Plant List (Lichvar 2013).

There are no U. S. Fish & Wildlife Service listed threatened or endangered taxa, however there are some species worthy of note:

Agave murpheyi (Hohokam Agave) is listed by the USFWS and Arizona Rare Plant Committee as a Species of Concern due to its rarity and status as an ancient cultivar (ARPC 2001). This succulent reproduces asexually primarily, and is found in central Arizona and northwestern Mexico. It was used by the Hohokam people for food and fiber, and is associated with basaltic pre-Columbian archeological sites and/or features (Hodgson 2001, Hodgson & Salywon 2013). Only one clone was found, at the base of the south side of Elephant Mountain. The clone was dead, but a representative specimen was collected and identified.

Malacothamnus fasciculatus (chaparral mallow), a pink-flowered subshrub, is a new record for the flora of Arizona for both the genus and species (Hunkins & Smith 2012). It is disjunct by approximately 250 mi (400 km) from its other known native populations in California and Baja California. It appeared in 2010 in Cottonwood Creek, a second time downstream the following year, and once again further downstream in 2012. It has not been observed since the 2012 sighting.

Possible explanations for its initial appearance are that its seed was carried in by birds, hikers, or horses.

The study area lies at the central, southern edge of the Central Arizona Highlands. This region is a predicted hotspot in the state for endemic plant species according to a recent MaxEnt model in a GIS-based report by Hodgson et al. 2013. Based on the checklist in this report, the SCRCA has seven taxa endemic to Arizona: *Agave chrysantha*, *Cylindropuntia acanthocarpa* var. *thornberi*, *C. ×tetracantha* (a hybrid between *C. acanthocarpa* and *C. leptocaulis*), *Dudleya saxosa* ssp. *collomiae*, *Echinocereus yavapaiensis* (Fig. 3C), *Eriogonum arizonicum*, and *Penstemon subulatus*.

This inventory fills a gap in the floristic knowledge of the region. Among its potential uses will be to help land managers make informed decisions, aid interpretive programs, and benefit future research involving plant species of the area. The Conservation Area's position on a geologic and vegetational transition zone, its rare riparian areas, and higher precipitation than other desert community types contributes to its botanical richness and endemism. Protecting it from development was an important step in preserving some of the remaining biodiversity on the edge of one of the largest metropolitan areas in the United States.

Table 1. Taxonomic composition of the Spur Cross Ranch Conservation Area flora.

Taxonomic Group	Families	Genera	Species	Additional Infraspecific taxa	Interspecific Hybrids	Total taxa
Pteridophytes	2	5	7	0	0	7
Gymnosperms	2	2	2	0	0	2
Angiosperms						
Dicots	62	224	323	1	2	326
Monocots	7	37	58	3	0	61
Totals	73	268	390	4	2	396

Figure 1. Maricopa County Parks and Recreation map showing area covered by Spur Cross Ranch Conservation Area (SCRCA) and the trails within its borders.

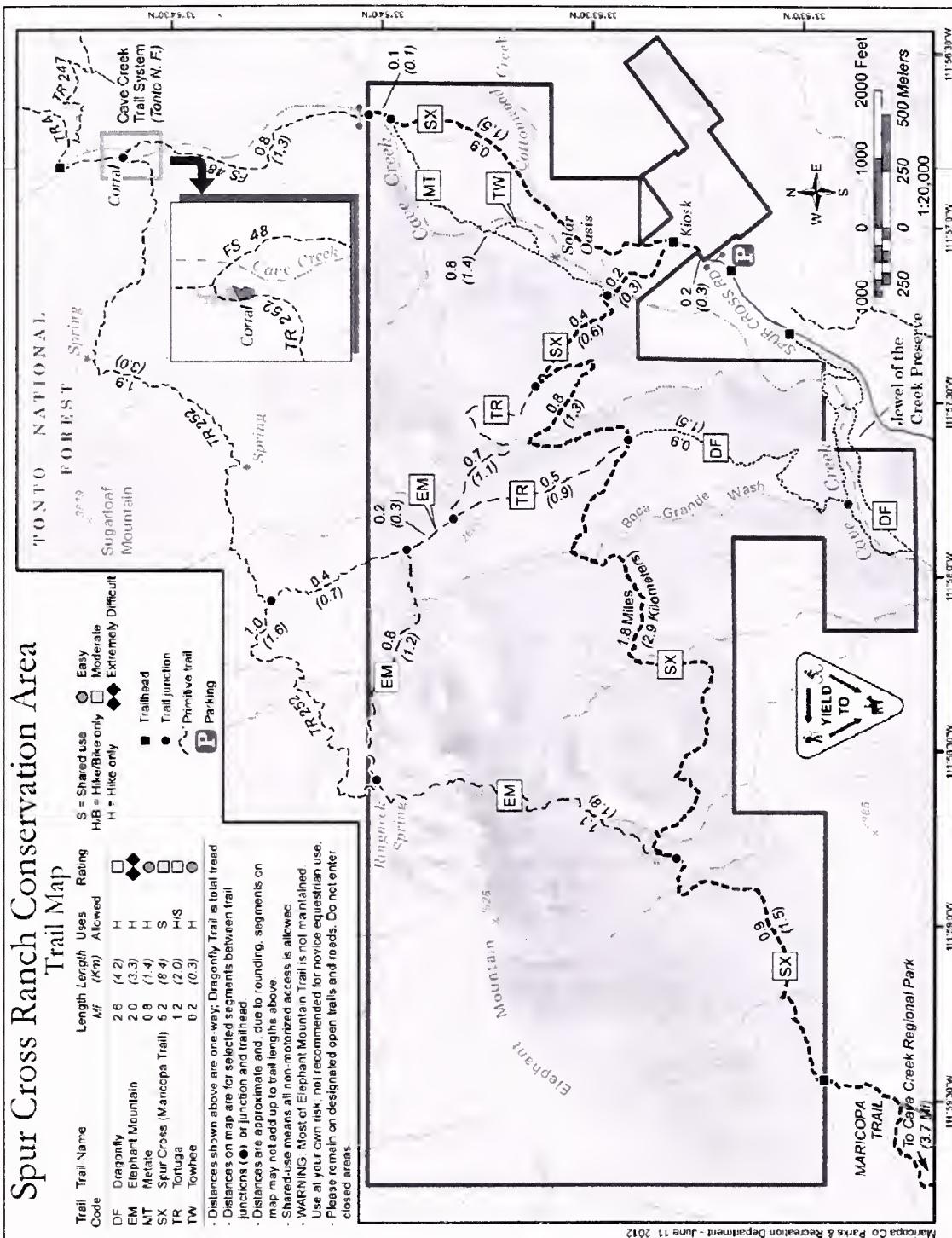


Table 2. Number of taxa by life form and percent of total flora, in the SCRCA.

Life Form	Number of Taxa*	Percent of Total Flora
Tree	16	4
Shrub/Subshrub	63	16
Succulent	19	5
Perennial Herb	108	27
Ephemeral	190	48

* Refers to the number of species plus 4 additional infraspecific taxa and 2 interspecific hybrids

Table 3. The best represented plant families of the Spur Cross Ranch Conservation Area.

Family	Genera	Species	Percent of total flora
Asteraceae	50	62	16
Poaceae	30	49*	12
Fabaceae	16	26	7
Boraginaceae	10	19	5
Brassicaceae	11	15	4
Cactaceae	6	15+	4
Plantaginaceae	7	14	4
Polygonaceae	6	12	3
Polemoniaceae	8	11	3
Euphorbiaceae	3	11	3

* Includes 2 varieties of *Aristida purpurea*, 2 varieties of *Bouteloua barbata* and 2 varieties of *Vulpia microstachya*.

+ Includes 2 varieties of *Opuntia engelmannii* and 2 interspecific hybrids: *Cylindropuntia × tetracantha* (a hybrid between *C. acanthocarpa* and *C. leptocaulis*) and *Opuntia engelmannii × phaeacantha*.

ANNOTATED CHECKLIST OF VASCULAR PLANTS OF THE SPUR CROSS RANCH CONSERVATION AREA, MARICOPA COUNTY, ARIZONA

Taxa are divided into the major plant groups, Pteridophytes, Gymnosperms, and Angiosperms: Dicots and Monocots. Within these groups, plants are listed alphabetically by family, genus, species and infraspecific rank. Infraspecific taxa are given only when more than one occurs in Arizona and a distinction could be made at that rank. Family names follow the Angiosperm Phylogeny Group III system of classification (Stevens 2013). Tropicos (2013) is the main database used for names not

covered in Vascular Plants of Arizona Project and Flora of North America treatments, and is the source for author names, abbreviations, and a few nomenclatural updates. Synonomy is derived mainly from Arizona Flora (Kearney et al. 1960). Taxa not native to North America are preceded by an asterisk (*), taxa endemic to Arizona are preceded by a pound sign (#), and a new record for the state is noted in boldface. Relative abundance classifications are subjective observations by the authors taken over the course of the study and are based on terms from Palmer et al. (1995). All collections were made by the authors except where the collection number is preceded by the collector's last name.

PTERIDOPHYTES (ferns and lycophytes)

PTERIDACEAE

Astrolepis cochisensis (Goodd.) D. M. Benham & Windham. [*Notholaena sinuata* (Lag. ex Sw.) Kaulf. var. *cochisensis* (Goodd.) Weath.]. Cochise scaly cloakfern. Perennial herb; occasional. 632.
Astrolepis sinuata (Lag. ex Sw.) D. M. Benham & Windham [*Notholaena sinuata* (Lag. ex Sw.) Kaulf.]. Wavy scaly cloakfern. Perennial herb; occasional. 140.
Cheilanthes covillei Maxon. Coville's lipfern. Perennial herb; occasional. 144, 368.
Cheilanthes parryi Domin. Parry's lipfern. Perennial herb; occasional. 624.
Notholaena standleyi Maxon. Star cloakfern. Perennial herb; occasional. 495, 498.
Pellaea truncata Goodd. [*P. longimucronata* auct. non Hook.]. Spiny cliffbrake. Perennial herb; occasional. 143, 491.

SELAGINELLACEAE

Selaginella arizonica Maxon. Arizona spikemoss. Perennial herb; common on rocky, north-facing slopes. 142.

GYMNOSPERMS (cone-bearing plants)

CUPRESSACEAE

Juniperus arizonica R. P. Adams. Redberry juniper. Tree; infrequent, mainly on north face of Elephant Mountain. 483.

EPHEDRACEAE

Ephedra aspera Engelm. ex S. Watson. [*E. nevadensis* S. Watson var. *aspera* (Engelm. ex S. Watson) L. D. Benson]. Rough jointfir. Shrub; occasional. 346, 613.

ANGIOSPERMS (flowering plants)

DICOTS

ACANTHACEAE

Anisacanthus thurberi (Torr.) A. Gray. Thurber's desert honeysuckle. Shrub; rare. 471.
Carlowrightia arizonica A. Gray. Arizona wrightwort. Subshrub; occasional. 428, 671.
Justicia californica (Benth.) D. N. Gibson. [*Beloperone californica* Benth.]. Beloperone, Chuparosa. Shrub; locally common to occasional. 258.

AMARANTHACEAE (includes CHENOPODIACEAE)

**Alternanthera caracasana* Kunth. Khakiweed. Perennial herb; rare, found once in dry stream bed of Cave Creek. 568A.

**Amaranthus albus* L. Prostrate pigweed. Ephemeral; occasional. 431, 517, 596.

**Amaranthus blitoides* S. Watson. Mat amaranth. Ephemeral; locally common to occasional. 456, 461.

Amaranthus fimbriatus (Torr.) Benth. ex S. Watson. Fringed amaranth. Ephemeral; rare. 561.

Atriplex canescens (Pursh) Nutt. var. *canescens*. Fourwing saltbush. Shrub; infrequent. 528, 697.

Atriplex elegans (Moq.) D. Dietr. var. *elegans*. Wheelscale saltbush. Ephemeral; rare, in disturbed area. 582.

Chenopodium fremontii S. Watson. Fremont's goosefoot. Ephemeral; common. 513, 597.

**Kochia scoparia* (L.) Schrad. Burningbush. Ephemeral; rare, found once in dry stream bed of Cave Creek. 545.

Monolepis nuttalliana (Schult.) Greene. Nuttall's povertyweed. Ephemeral; rare, in disturbed area. 184.

**Salsola tragus* L. [*S. kali* L. var. *tenuifolia* Tausch]. Prickly Russian thistle, Tumbleweed. Ephemeral; occasional. 439, 516.

ANACARDIACEAE

**Rhus lancea* L. f. African sumac. Tree; rare, only one found along Cave Creek. *Makings* 3876.

Rhus ovata S. Watson. Sugar sumac. Shrub; rare. 605.

APIACEAE

Bowlesia incana Ruiz & Pav. Hoary bowlesia. Ephemeral; occasional. 180.

Daucus pusillus Michx. American wild carrot. Ephemeral; occasional. 279.

Lomatium nevadense (S. Watson) J. M. Coulter & Rose var. *parishii* (J. M. Coulter & Rose) Jeps. Parish's biscuitroot. Perennial herb; infrequent. 360.

APOCYNACEAE (includes ASCLEPIADACEAE)

Cynanchum arizonicum (A. Gray) Shinners. [*Metastelma arizonicum* A. Gray]. Arizona swallow-wort. Perennial Herb (vine); occasional. 502, 557.

Matelea parvifolia (Torr.) Woodson. [*Gonolobus parvifolius* Torr.]. Spearleaf. Perennial herb; infrequent. 670.

Sarcostemma cynanchoides Decne. ssp. *hartwegii* (Vail) R. W. Holm. [*Funastrum heterophyllum* (Engelm. ex Torr.) Standl.; *F. cynanchoides* Schltr. var. *hartwegii* (Vail) Krings]. Hartweg's twinevine, Rambling milkweed. Perennial herb (vine); occasional. 424, 468.

ARISTOLOCHIACEAE

Aristolochia watsonii Wooton & Standl. Watson's dutchman's pipe. Perennial herb; infrequent. 556.

ASCLEPIADACEAE, see APOCYNACEAE

ASTERACEAE

Acourtia wrightii (A. Gray) Reveal & R. M. King. [*Perezia wrightii* A. Gray]. Brownfoot. Perennial herb; occasional. 399.

Adenophyllum porophylloides (A. Gray) Strother. [*Dyssodia porophylloides* A. Gray]. San Felipe dogweed. Perennial herb; occasional. 345.

Ambrosia ambrosioides (Cav.) W. W. Payne. [*Franseria ambrosioides* Cav.]. Canyon ragweed. Shrub; common in riparian areas. 340.

Ambrosia confertiflora DC. [*Franseria confertiflora* Rydb.]. Weakleaf bur ragweed. Perennial herb; locally common in disturbed areas. 576, 604.

Ambrosia deltoidea (Torr.) W. W. Payne. [*Franseria deltoidea* Torr.]. Triangle bur ragweed, Triangle bursage. Shrub; abundant. 309.

Ambrosia monogyra (Torr. & A. Gray) Strother & B. G. Baldwin. [*Hymenoclea monogyra* Torr. & A. Gray]. Singlewhorl burrobush. Shrub; common in riparian areas. 121, 598.

Artemisia dracunculus L. [*A. dracunculoides* Pursh]. Wild tarragon. Subshrub; rare. 746.

Artemisia ludoviciana Nutt. ssp. *albula* (Wooton) D. D. Keck. White sagebrush. Perennial herb; occasional. 591.

Baccharis salicifolia (Ruiz & Pav.) Pers. [*B. glutinosa* Pers.; *B. viminea* DC.]. Mule-fat. Shrub; common in riparian areas. 133.

Baccharis sarothroides A. Gray. Desertbroom. Shrub; common. 141, 601, 602.

Baccharis sergiloides A. Gray. Desert baccharis, Seepwillow. Shrub; infrequent in drainages. 570, 572.

Bahia biternata A. Gray. Slimlobe bahia. Ephemeral; occasional. 543.

Bahiopsis parishii (Greene) E. E. Schill. & Panero. [*Viguiera deltoidea* A. Gray var. *parishii* (Greene) Vasey & Rose; *V. parishii* Greene]. Parish's goldeneye. Shrub; common. 234.

Baileya multiradiata Harv. & A. Gray ex Torr. Desert marigold. Perennial herb; common. 378.

Bebbia junccea Greene. Chuckwalla's delight, Sweetbush. Shrub; common. 421.

Brickellia atractyloides A. Gray. Spearleaf brickellbush. Subshrub; occasional, north face of Elephant Mountain. 374.

Brickellia californica (Torr. & A. Gray) A. Gray. California brickellbush. Subshrub; rare, spring on north side of Elephant Mountain. 695.

Brickellia coulteri A. Gray var. *brachiata* (A. Gray) B. L. Turner. Coulter's brickellbush. Subshrub; occasional. 418.

**Centaurea melitensis* L. Maltese star-thistle. Ephemeral; locally common to occasional, currently being managed for removal. 322, 379A.

Chaenactis carphoclinia A. Gray. Pebble pincushion. Ephemeral; rare, in disturbed area. 329.

Cirsium neomexicanum A. Gray. New Mexico thistle. Ephemeral; occasional. 339.

Dieteria asteroides Torr. var. *glandulosa* (B. L. Turner) D. R. Morgan & R. L. Hartm. [*Machaeranthera asteroides* (Torr.) Greene var. *glandulosa* B. L. Turner]. Fall tansyaster. Ephemeral; occasional. 470.

**Dimorphotheca sinuata* DC. Glandular Cape marigold. Ephemeral; rare. 702.

Encelia farinosa A. Gray ex Torr. Brittlebush. Shrub; abundant. 351.

Ericameria laricifolia (A. Gray) Shinners. [*Haplopappus laricifolius* A. Gray]. Turpentine bush. Shrub; occasional. 593.

Ericameria linearifolia (DC.) Urbatsch & Wussow. [*Haplopappus linearifolius* DC.]. Narrowleaf goldenbush. Shrub; infrequent. 365.

Erigeron canadensis L. [*Conyza canadensis* (L.) Cronquist]. Canadian horseweed. Ephemeral; occasional. 544.

Erigeron divergens Torr. & A. Gray. Spreading fleabane. Ephemeral; common. 332, 587.

Eriophyllum lanosum A. Gray [*Antheropeas lanosum* (A. Gray) Rydb.]. White easterbonnets. Ephemeral; occasional. 196, 243.

Gutierrezia sarothrae (Pursh) Britton & Rusby. Broom snakeweed. Shrub; occasional. 594.

Helianthus annuus L. Common sunflower. Ephemeral; occasional in dry stream bed. 427.

Heliomeris longifolia (B. L. Rob. & Greenm.) Cockerell var. *annua* (M. E. Jones) Yates. [*Viguiera annua* S. F. Blake]. Longleaf false goldeneye. Ephemeral; occasional in dry stream bed. 592, 599.

Heterotheca subaxillaris (Lam.) Britton & Rusby ssp. *latifolia* (Buckley) Semple. [*H. psammophila* Wagenkn.]. Camphorweed. Ephemeral; occasional in dry stream bed. 532.

Hymenothrix loomisii S. F. Blake. Loomis' thimblehead. Ephemeral; rare. 745.

Isocoma acradenia (Greene) Greene var. *acradenia*. Alkali goldenbush. Shrub; locally common to occasional in disturbed area. 588.

**Lactuca serriola* L. Prickly lettuce. Ephemeral; occasional. 684.

Lasthenia gracilis (DC.) Greene. [*Baeria chrysostoma* Fisch. & C. A. Meyer subsp. *gracilis* (DC.) Ferris]. Needle goldfields. Ephemeral; rare. 269.

Layia glandulosa (Hook.) Hook. & Arn. Whitedaisy tidytips. Ephemeral; occasional. 636.

Logfia filaginoides (Hook. & Arn.) Morefield. [*L. californica* (Nutt.) Holub; *Filago californica* Nutt.]. California cottonrose. Ephemeral; occasional. 259.

Machaeranthera tagetina Greene. [*Aster tagetinus* (Greene) S.F. Blake]. Mesa tansyaster. Ephemeral; rare. 743.

Melampodium leucanthum Torr. & A. Gray. Plains blackfoot. Blackfoot daisy. Perennial herb; occasional on north face of Elephant Mountain. 640.

**Oncosiphon piluliferum* (L.f.) Källersjö. Stinknet. Globe chamomile. Ephemeral; locally common. 264.

Packera quercetorum (Greene) C. Jeffrey. [*Senecio quercetorum* Greene]. Oak Creek ragwort. Perennial herb; rare. 654.

Pluchea sericea (Nutt.) Coville. [*Tessaria sericea* (Nutt.) Shinners]. Arrowweed. Shrub; rare, in riparian areas. 725, 751.

Porophyllum gracile Benth. Slender poreleaf, Odora. Perennial herb; occasional. 358.

**Pseudognaphalium luteoalbum* (L.) Hilliard & B. L. Burtt. [*Gnaphalium luteoalbum* L.]. Jersey cudweed. Ephemeral; infrequent. 466.

Psilosrophe cooperi (A. Gray) Greene. Whitestem paperflower. Subshrub; infrequent. 397.

Rafinesquia californica Nutt. California plumeseed. Ephemeral; occasional. 270, 362, 645, 707.

Rafinesquia neomexicana A. Gray. New Mexico plumeseed, Desert chicory. Ephemeral; common. 206.

Senecio flaccidus Less. var. *monoensis* (Greene) B. L. Turner & T. M. Barkley. [*S. monoensis* Greene; *S. douglasii* DC. var. *monoensis* (Greene) Jeps.]. Smooth threadleaf ragwort. Subshrub; infrequent. 733.

Senecio lemmonii A. Gray. Lemmon's ragwort. Perennial herb; occasional. 359, 417, 486.

**Senecio vulgaris* L. Old-man-in-the-Spring. Ephemeral; rare. 334.

**Sonchus asper* (L.) Hill. Spiny sowthistle. Ephemeral; occasional. 658, 729.

**Sonchus oleraceus* L. Common sowthistle. Ephemeral; occasional. 225, 478, 503.

Stephanomeria pauciflora (Torr.) A. Nelson. Brownplume wirelettuce. Perennial herb; occasional. 131, 395, 676.

Stylocline micropoides A. Gray. Woollyhead neststraw. Ephemeral; occasional. 274, 295.

Symphyotrichum subulatum (Miehx.) G. L. Nesom var. *parviflorum* (Nees) S. D. Sundb. [*S. expansum* (Poepp. ex Spreng.) G.L. Nesom]. Southwestern annual saltmarsh aster. Ephemeral; occasional. 541.

Trixis californica Kellogg. American threefold. Shrub; occasional. 312.

Uropappus lindleyi (DC.) Nutt. Lindley's Silverpuffs. [*Microseris linearifolia* (Nutt.) Sch. Bip.; *M. lindleyi* (DC.) A. Gray]. Ephemeral; common. 223.

Verbesina encelioides (Cav.) A. Gray. Golden crownbeard. Ephemeral; infrequent. 458, 531.

Xanthisma spinulosum (Pursh) D. R. Morgan & R. L. Hartm. var. *goooddingii* (A. Nelson) D. R. Morgan & R. L. Hartm. [*Haplopappus spinulosus* (Pursh) DC. var. *goooddingii* (A. Nelson) S. F. Blake; *Machaeranthera pinnatifida* (Hook.) Shinners var. *goooddingii* (A. Nelson) B. L. Turner & R. L. Hartm.]. Gooodding's tansyaster. Subshrub; occasional. 299.

Xanthium strumarium L. Rough cocklebur. Ephemeral; common. 135.

BORAGINACEAE (includes HYDROPHYLACEAE)

Amsinckia intermedia Fisch. & C. A. Mey. Common fiddleneck. Ephemeral; common. 159, 188.

Amsinckia tessellata A. Gray. Bristly fiddleneck. Ephemeral; infrequent. 183.

Cryptantha barbigera (A. Gray) Greene. Bearded cryptantha. Ephemeral; common. 296.

Cryptantha decipiens (M.E. Jones) A. Heller. Gravelbar cryptantha. Ephemeral; occasional. 297.

Cryptantha pterocarya (Torr.) Greene var. *cycloptera* (Greene) J.F. Macbr. Wingnut cryptantha. Ephemeral; occasional. 249, 291.

Emmenanthe penduliflora Benth. Whisperingbells. Ephemeral; occasional. 199.

Eriodictyon angustifolium Nutt. Narrowleaf yerba santa. Shrub; rare, found only in Cottonwood Creek. 691, 757.

Eucryptia chrysanthemifolia Greene. Spotted hideseed. Ephemeral; locally common to occasional. 158.

Harpagonella palmeri A. Gray var. *arizonica* I.M. Johnst. Arizona grapplinghook. Ephemeral; locally common to occasional. 163.

Pectocarya heterocarpa (I. M. Johnst.) I. M. Johnst. Chuckwalla combseed. Ephemeral; occasional. 256.

Pectocarya platycarpa (Munz & I. M. Johnst.) Munz & I. M. Johnst. Broadfruit combseed. Ephemeral; occasional. 189, 268.

Pectocarya recurvata I. M. Johnst. Curvenut combseed. Ephemeral, common. 145.

Phacelia affinis A. Gray. Limestone phacelia. Ephemeral; occasional. 335, 412.

Phacelia crenulata Torr. ex S. Watson var. *ambigua* (M. E. Jones) J. F. Macbr. [*P. ambigua* M. E. Jones]. Purplestem phacelia, Scorpionweed. Ephemeral; occasional. 262, 265, 306.

Phacelia cryptantha Greene. Hiddenflower phacelia. Ephemeral; occasional. 369.

Phacelia distans Benth. Distant phacelia, Wild heliotrope. Ephemeral; locally common to occasional. 202, 233, 320.

Phacelia pedicellata A. Gray. Pedicellate phacelia. Ephemeral; rare. 629, 641.

Pholistoma auritum (Lindl.) Lilja var. *arizonicum* (M. E. Jones) Constance. Arizona fiestaflower. Ephemeral; occasional. 162, 271.

Plagiobothrys arizonicus (A. Gray) Greene ex A. Gray. Arizona Popcornflower. Ephemeral; occasional. 207, 336.

BRASSICACEAE

Boechera perennans (S. Watson) W. A. Weber. [*Arabis perennans* S. Watson]. Perennial rockcress. Perennial herb; infrequent. 251.

**Brassica tournefortii* Gouan. Asian mustard, Sahara mustard. Ephemeral; locally common to occasional. 214, 386.

**Capsella bursa-pastoris* (L.) Medik. Shepherd's purse. Ephemeral; occasional. 267.

Caulanthus lasiophyllus (Hook. & Arn.) Payson. [*Thelypodium lasiophyllum* (Hook. & Arn.) Greene; *Guillenia lasiophylla* (Hook. & Arn.) Greene]. California mustard. Ephemeral; common. 164, 176, 182, 240.

Descurainia pinnata (Walter) Britton. Western tansymustard. Ephemeral; occasional. 338.

Draba cuneifolia Nutt. ex Torr. & A. Gray var. *integrifolia* S. Watson. Wedgeleaf draba. Ephemeral; occasional. 187.

Lepidium densiflorum Schrad. Common pepperweed. Ephemeral; common. 194, 209.

Lepidium lasiocarpum Nutt. Shaggyfruit pepperweed. Ephemeral; common. 211.

Lepidium virginicum L. Virginia pepperweed. Ephemeral; occasional. 276.

**Nasturtium officinale* W. T. Aiton. [*Rorippa nasturtium-aquaticum* (L.) Hayek]. Watercress.

Perennial herb; common. 463.

Physaria gordoni (A. Gray) O'Kane & Al-Shehbaz. [*Lesquerella gordoni* (A. Gray) S. Watson]. Gordon's bladderpod. Ephemeral; common. 208.

Physaria tenella (A. Nelson) O'Kane & Al-Shehbaz. [*Lesquerella tenella* A. Nelson]. Moapa bladderpod. Ephemeral; occasional. 282.

**Sisymbrium irio* L. London rocket. Ephemeral; common. 161, 191.

**Sisymbrium orientale* L. Indian hedge mustard. Ephemeral; infrequent. 652.

Thysanocarpus curvipes Hook. [*T. amplexens* Greene]. Sand fringepod. Ephemeral; common. 177, 625.

CACTACEAE

Carnegiea gigantea (Engelm.) Britton & Rose. [*Cereus giganteus* Engelm.]. Saguaro. Succulent; abundant. 429.

#*Cylindropuntia acanthocarpa* (Engelm. & J. M. Bigelow) F. M. Knuth var. *thornberi* (Thornber & Bonker) Backeb. [*Opuntia thornberi* Thornber & Bonker; *Opuntia acanthocarpa* Engelm. & J. M. Bigelow var. *thornberi* (Thornber & Bonker) L. D. Benson]. Thornber's buckhorn cholla. Succulent; abundant. 406.

Cylindropuntia arbuscula (Engelm.) F. M. Knuth. [*Opuntia arbuscula* Engelm.]. Arizona pencil cholla. Succulent; rare. 606.

Cylindropuntia bigelovii (Engelm.) F. M. Knuth. Teddybear cholla. Succulent; locally common to occasional. 404.

Cylindropuntia fulgida (Engelm.) F. M. Knuth var. *fulgida*. [*Opuntia fulgida* Engelm.]. Jumping cholla, Chainfruit cholla. Succulent; locally common to occasional. 515.

Cylindropuntia leptocaulis (DC.) F. M. Knuth. [*Opuntia leptocaulis* DC.]. Christmas cactus. Succulent; occasional. 435.

#*Cylindropuntia* × *tetracantha* (Toumey) F. M. Knuth. A hybrid between *C. acanthocarpa* and *C. leptocaulis*. Tucson pricklypear. Succulent; rare. 609, 669.

Echinocereus engelmannii (Parry ex Engelm.) Lem. ssp. *fasciculatus*. Engelmann's hedgehog cactus. Succulent; common. 363, 713.

#*Echinocereus yavapaiensis* M. A. Baker. Yavapai claret-cup cactus. Succulent; occasional on upper slopes of Elephant Mountain. 370, 703.

Ferocactus cylindraceus (Engelm.) Orcutt. Desert barrel cactus. Succulent; common. 482.

Mammillaria grahamii Engelm. [*M. microcarpa* Engelm.]. Graham's nipple cactus, Pincushion cactus. Succulent; occasional. 667, 668.

Opuntia chlorotica Engelm. & J. M. Bigelow. Dollarjoint pricklypear, Pancake pricklypear. Succulent; occasional. 484.

Opuntia engelmannii Salm-Dyck ex Engelm. var. *engelmannii*. Cactus apple, Engelmann's prickly pear. Succulent; abundant. 403, 405.

Opuntia engelmannii Salm-Dyck var. *linguiformis* (Griffiths) B. D. Parfitt & Pinkava. Cow's tongue pricklypear. Succulent; rare, along roadside. Native to Texas and Mexico. 672.

Opuntia engelmannii × *phaeacantha*. Succulent; infrequent. 687.

CAMPANULACEAE

Nemacladus glanduliferous Jeps. var. *orientalis* McVaugh. Glandular threadplant. Ephemeral; infrequent. 674, 719.

CANNABACEAE (includes Ulmaceae, in part)

**Cannabis sativa* L. Marijuana. Ephemeral, rare. Found planted near Cave Creek, removed. 730.

Celtis pallida Torr. Spiny hackberry. Desert hackberry. Shrub; common in major drainages to occasional elsewhere. 136

Celtis reticulata Torr. [*C. laevigata* var. *reticulata* (Torr.) L.D. Benson]. Netleaf hackberry. Tree; infrequent. 361.

CAPPARACEAE

Polanisia dodecandra (L.) DC. var. *trachysperma* (Torr. & A. Gray) Iltis. [*P. trachysperma* Torr. & A. Gray]. Sandyseed Clammyweed. Ephemeral; occasional, in dry stream beds. 476.

CARYOPHYLLACEAE

**Herniaria hirsuta* L. var. *cinerea* (DC.) Loret & Barrandon. [*H. cinerea* DC.]. Hairy rupturewort. Ephemeral; common. 195.

Silene antirrhina L. Sleepy silene. Ephemeral; occasional. 247, 277.

**Stellaria media* (L.) Vill. Common chickweed. Ephemeral; rare. 612.

Stellaria nitens Nutt. Shiny chickweed. Ephemeral; occasional. 272.

CELASTRACEAE

Canotia holacantha Torr. Crucifixion thorn. Shrub; locally common on north face of Elephant Mountain. 364, 480.

CHENOPodiACEAE, see AMARANTHACEAE

CONVOLVULACEAE

Calystegia longipes (S. Watson) Brummitt. [*Convolvulus linearilobus* Eastw.]. Paiute false bindweed. Perennial herb; infrequent. 462.

Convolvulus equitans Benth. Texas bindweed. Perennial herb; occasional. 685, 686.

Cuscuta indecora Choisy. Bigseed alfalfa dodder. Perennial herb; occasional. 473.

Ipomoea barbatisepala A. Gray. Canyon morning-glory. Ephemeral; infrequent. 550.

Ipomoea costellata Torr. Crestrib morning-glory. Ephemeral; occasional. 589.

Ipomoea cristulata Hallier f. Trans-Pecos morning-glory. Ephemeral; occasional. 425, 549.

CRASSULACAE

Crassula connata (Ruiz & Pav.) A. Berger. [*Tillaea erecta* Hook. & Arn.; *Crassula erecta* (Hook. & Arn.) A. Berger]. Sand pygmyweed. Ephemeral; occasional. 185.

#*Dudleya saxosa* (M.E. Jones) Britton & Rose ssp. *collomiae* (Rose) Moran. [*Echeveria collomiae* (Rose) Kearney & Peebles, *D. collomiae* Rose]. Gila County liveforever, Rock echeveria. Perennial herb; occasional. 356.

CROSSOSOMATACEAE

Crossosoma bigelovii S. Watson. Ragged rockflower. Shrub; occasional. 229.

CUCURBITACEAE

Marah gilensis (Greene) Greene. Gila manroot, wild cucumber. Perennial herb (vine); locally common to occasional. 263.

CUSCUTACEAE, see CONVOLVULACEAE

EUPHORBIACEAE

Acalypha neomexicana Müll. Arg. New Mexico copperleaf. Ephemeral; rare. 553.

Ditaxis lanceolata (Benth.) Pax & K. Hoffm. [*Argythamnia lanceolata* (Benth.) Müll. Arg.]. Narrowleaf silverbush. Subshrub; occasional. 236, 496.

Ditaxis neomexicana (Müll. Arg.) A. Heller. [*Argythamnia neomexicana* Müll. Arg.]. New Mexico silverbush. Perennial herb; occasional. 116.

Euphorbia abramsiana L. C. Wheeler. [*Chamaesyce abramsiana* (L. C. Wheeler) Koutnik]. Abrams' sandmat. Ephemeral, occasional. 129.

Euphorbia albomarginata Torr. & A. Gray. [*Chamaesyce albomarginata* (Torr. & A. Gray) Small]. Whitemargin sandmat. Perennial herb; occasional. 574.

Euphorbia arizonica Engelm. [*Chamaesyce arizonica* (Engelm.) Arthur]. Arizona spurge. Perennial herb; occasional. 128.

Euphorbia capitellata Engelm. [*Chamaesyce capitellata* (Engelm.) Millsp.]. Head sandmat. Perennial herb; occasional. 127, 649.

Euphorbia eriantha Benth. Beetle spurge, Desert poinsettia. Ephemeral; infrequent. 115, 657.

Euphorbia florida Engelm. [*Chamaesyce florida* (Engelm.) Millsp.]. Chiricahua Mountain sandmat. Ephemeral; occasional. 534.

Euphorbia melanadenia Torr. [*Chamaesyce melanadenia* (Torr.) Millsp.]. Red-gland spurge. Perennial herb; common. 122.

Euphorbia pediculifera Engelm. var. *pediculifera*. [*Chamaesyce pediculifera* (Engelm.) Rose & Standl]. Carrizo Mountain sandmat, Louse spurge. Perennial herb; common. 255, 354, 575.

FABACEAE

Acacia greggii A. Gray. [*Senegalia greggii* (A. Gray) Britton & Rose]. Catclaw acacia. Shrub; abundant. 530.

Astragalus arizonicus A. Gray. Arizona milkvetch. Perennial herb; occasional. 333, 474, 648.

Astragalus nuttallianus DC. Smallflowered milkvetch. Ephemeral; locally common to occasional. 304.

Astragalus tephrodes A. Gray var. *brachylobus* (A. Gray) Barneby. Ashen milkvetch. Perennial herb; occasional. 662.

Calliandra eriophylla Benth. Fairyduster. Shrub; common. 311.

Lotus humistratus Greene. Foothill deervetch. Ephemeral; locally common to occasional. 237, 292.

Lotus rigidus (Benth.) Greene. Shrubby deervetch. Subshrub; occasional. 210.

Lotus salsuginosus Greene ssp. *brevivexillus* (Ottley) Munz. Coastal bird's-foot trefoil. Ephemeral; locally common to occasional. 238.

Lotus strigosus (Nutt.) Greene var. *tomentellus* (Greene) Isely. [*L. tomentellus* Greene]. Strigose bird's-foot trefoil. Ephemeral; locally common to occasional. 303, 305, 631.

Lupinus concinnus J. Agardh. Bajada lupine. Ephemeral; occasional. 383.

Lupinus sparsiflorus Benth. Coulter's lupine. Ephemeral; common. 201, 231.

Lupinus succulentus Douglas ex K. Koch. Hollowleaf annual lupine. Ephemeral; infrequent. 244.

Marina parryi (Torr. & A. Gray) Barneby. [*Dalea parryi* Torr. & A. Gray]. Parry's false prairie-clover. Perennial herb; occasional. 337.

**Medicago polymorpha* L. [*M. hispida* Gaertn.]. Burclover. Ephemeral; infrequent. 716.

**Melilotus indicus* (L.) All. Annual yellow sweetclover. Ephemeral; common. 289, 426, 500.

Mimosa aculeaticarpa Ortega var. *biuncifera* (Benth.) Barneby. [*M. biuncifera* Benth.] Catclaw mimosa. Shrub; infrequent. 467.

Olneya tesota A. Gray. Desert ironwood. Tree; common. 507.

Parkinsonia florida (Benth ex A. Gray) S. Watson. [*Cercidium floridum* Benth. ex A. Gray]. Blue paloverde. Tree; occasional. 434.

Parkinsonia microphylla Torr. [*Cercidium microphyllum* (Torr.) Rose & I. M. Johnst.]. Yellow paloverde, Foothill paloverde. Tree; abundant. 436.

Phaseolus angustissimus A. Gray. Slimleaf bean. Perennial herb; rare. 728.

Prosopis velutina Wooton. [*P. juliflora* (Sw.) DC. var. *velutina* (Wooton) Sarg.]. Velvet mesquite. Tree; abundant..

Senna covesii (A. Gray) H. S. Irwin & Barneby. [*Cassia covesii* A. Gray]. Coves' cassia. Subshrub; common. 506.

Trifolium albopurpureum Torr. & A. Gray. Rancheria clover. Ephemeral; occasional. 381.

Trifolium gracilentum Torr. & A. Gray. Pinpoint clover. Ephemeral; occasional. 388.

Trifolium mucronatum Willd. ex Spreng. ssp. *lacerum* (Greene) J.M. Gillett. [*T. lacerum* Greene].

Spinytooth clover. Perennial herb; occasional. 380.

Vicia ludoviciana Nutt. ex Torr. & A. Gray. [*V. exigua* Nutt.]. Louisiana vetch. Ephemeral; occasional. 245, 414.

FAGACEAE

Quercus turbinella Greene. Sonoran scrub oak. Shrub; infrequent, on upper slopes of north face of Elephant Mountain. 372.

FOUQUIERIACEAE

Fouquieria splendens Engelm. Ocotillo. Shrub; common. 377.

FUMARIACEAE

Corydalis aurea Willd. ssp. *aurea*. Scrambled eggs. Ephemeral; rare, on upper slopes of north face of Elephant Mountain. 633.

GENTIANACEAE

Zeltnera calycosa (Buckley) G. Mans. [*Centaurium calycosum* (Buckley) Fernald]. Arizona centaury. Ephemeral; occasional in riparian areas. 493, 525.

Zeltnera nudicaulis (Engelm.) G. Mans. [*Centaurium nudicaule* (Engelm.) B.L. Rob.] Santa Catalina Mountain centaury. Ephemeral; infrequent, in riparian areas. 520.

GERANIACEAE

**Erodium cicutarium* (L.) L' Hér. ex Aiton. Filaree. Ephemeral; common. 160.

Erodium texanum A. Gray. Texas filaree. Ephemeral; occasional. 226.

Geranium carolinianum L. Carolina geranium. Ephemeral; infrequent. 332A.

HYDROPHYLACEAE, see BORAGINACEAE

JUGLANDACEAE

Juglans major (Torr.) A. Heller. Arizona walnut. Tree; rare, along Cave Creek. 651.

KRAMERIACEAE

Krameria erecta Willd. ex Schult. [*K. parvifolia* Benth.]. Littleleaf ratany. Shrub; infrequent. 490.

Krameria bicolor S. Watson. [*K. grayii* Rose & Painter]. White ratany. Shrub; common. 437, 441.

LAMIACEAE

Hedeoma oblongifolia (A. Gray) A. Heller. Oblongleaf false pennyroyal. Perennial herb; occasional. 637.

Hyptis emoryi Torr. Desert lavender. Shrub; occasional. 350.

**Lamium amplexicaule* L. Henbit deadnettle. Ephemeral; occasional. 190.

**Marrubium vulgare* L. Horehound. Perennial herb; rare. 656.

Salazaria mexicana Torr. [*Scutellaria mexicana* (Torr.) A. J. Paton.]. Mexican bladdersage, Mexican paperbag bush. Shrub; occasional. 352.

Salvia columbariae Benth. Chia. Ephemeral; occasional. 200, 232, 644.

LOASACEAE

Mentzelia affinis Greene. Yellowcomet. Ephemeral; rare. 287.

Mentzelia albicaulis (Douglas ex Hook.) Douglas ex Torr. & A. Gray. Whitestem blazingstar. Ephemeral; occasional. 628.

Mentzelia multiflora (Nutt.) A. Gray. Adonis blazingstar. Perennial herb; occasional. 518.

LYTHRACEAE

Lythrum californicum Torr. & A. Gray. California loosestrife. Perennial herb; occasional, in Cave Creek. 521, 527.

MALPIGHIACEAE

Cottsia gracilis (A. Gray) W. R. Anderson & C. Davis. [*Janusia gracilis* A. Gray]. Slender janusia. Subshrub vine); occasional. 398, 559.

MALVACEAE (includes STERCULIACEAE)

Abutilon incanum (Link) Sweet. Pelotazo, Indian mallow. Subshrub; occasional. 494, 548.

Ayenia filiformis S. Watson. Trans-Pecos ayenia. Perennial herb; occasional. 618.

Herissantia crispa (L.) Brizicky. [*Gayoides crispum* (L.) Small]. Bladdermallow. Perennial herb; occasional. 138, 562.

Hibiscus coulteri Harv. ex A. Gray. Desert rosemallow. Subshrub; infrequent. 497, 558.

Malacothamnus fasciculatus (Nutt. ex Torr. & A. Gray) Greene. Mendocino bushmallow, Chaparral mallow. Subshrub; rare, along Cave Creek. Not seen since 2012. 717, 740, 747. **New record for Arizona.**

**Malva parviflora* L. Cheeseweed mallow. Ephemeral; locally common. 266.

**Sida abutifolia* Mill. [*S. procumbens* Sw.]. Spreading fanpetals. Perennial herb; rare. 536.

Sphaeralcea ambigua A. Gray ssp. *ambigua*. Apricot globemallow, Desert globemallow. Subshrub; locally common to occasional. 313, 673.

Sphaeralcea rusbyi A. Gray. Rusby's globemallow. Perennial herb; infrequent. 455.

MARTYNIACEAE

Proboscidea parviflora (Wooton) Wooton & Standl. ssp. *parviflora*. [*Martynia parviflora* Wooton]. Devil's claw. Ephemeral; rare. 573.

MONTIACEAE (includes PORTULACACEAE, in part)

Calandrinia ciliata (Ruiz & Pav.) DC. Fringed redmaids. Ephemeral; occasional. 179.

Cistanthe monandra (Nutt.) Hershk. [*Calyptidium monandrum* Nutt.]. Common pussypaws. Ephemeral; occasional. 701.

Claytonia perfoliata Donn ex Willd. ssp. *mexicana* (Rydb.) J. M. Miller & K. L. Chambers. [*Limnia mexicana* Rydb.] Miner's Lettuce. Ephemeral; occasional. 213.

NYCTAGINACEAE

Allionia incarnata L. Trailing windmills. Perennial herb; occasional. 666, 678.

Boerhavia coccinea Mill. Scarlet spiderling. Perennial herb; occasional. 499, 539.

Boerhavia intermedia M. E. Jones. Fivewing spiderling. Ephemeral; occasional. 533.

Mirabilis coccinea (Torr.) Benth. & Hook. f. [*Oxybaphus coccineus* Torr.]. Scarlet four o'clock. Perennial herb; infrequent. 485, 639.

Mirabilis laevis (Benth.) Curran var. *villosa* (Kellogg) Spellenb. [*M. bigelovii* A. Gray]. Wishbone-bush. Perennial herb; common. 246.

Mirabilis multiflora (Torr.) A. Gray var. *multiflora*. Colorado four o'clock. Perennial herb; rare. 469, 583.

OLEACEAE

Fraxinus velutina Torr. Velvet ash. Tree; common in riparian areas. 420.

Menodora scabra A. Gray. [*M. scoparia* Engelm. ex A. Gray]. Rough menodora. Shrub; occasional. 310.

ONAGRACEAE

Camissonia californica (Nutt. ex Torr. & A. Gray) P. H. Raven. [*Oenothera leptocarpa* Greene]. California Suncup. Ephemeral; occasional. 230, 416, 433.

Camissonia cardiophylla (Torr.) P. H. Raven. Heartleaf suncup. Ephemeral; rare. 630.

Camissonia chamaenerioides (A. Gray) P. H. Raven. [*Oenothera chamaenerioides* A. Gray]. Longcapsule suncup. Ephemeral; infrequent. 275, 393.

Camissonia micrantha (Hornem. ex Spreng.) P. H. Raven. [*Oenothera micrantha* Hornem. ex Spreng.]. Miniature suncup. Ephemeral; infrequent. 387, 722.

Clarkia epilobioides (Nutt. ex Torr. & A. Gray) A. Nelson and J. F. Macbr. [*Godetia epilobioides* (Nutt. ex Torr. & A. Gray) S. Watson]. Canyon clarkia. Ephemeral; rare. 285.

Oenothera cespitosa ssp. *marginata* (Nutt. ex Hook. & Arn.) Munz. Tufted evening primrose.

Perennial herb; occasional. 683.

Oenothera elata Kunth ssp. *hirsutissima* (A. Gray ex S. Watson) W. Dietr. [*O. hookeri* Torr. & A. Gray var. *hirsutissima* (A. Gray ex S. Watson) Munz]. Hooker's evening primrose. Subshrub; infrequent. 742.

Oenothera primiveris A. Gray. Desert evening primrose. Ephemeral; infrequent. 224.

OROBANCHACEAE (includes SCROPHULARIACEAE, in part)

Castilleja applegatei Fernald ssp. *martinii* (Abrams) T. I. Chuang & Heckard. [*C. chromosa* A. Nelson; *C. angustifolia* (Nutt.) G. Don var. *dubia* A. Nelson]. Wavyleaf Indian paintbrush. Perennial herb; occasional. 349, 620.

Castilleja exserta (A. Heller) T. I. Chuang & Heckard. [*Orthocarpus purpurascens* Benth.]. Exserted Indian paintbrush, Owl clover. Ephemeral; locally common to occasional. 186, 242.

Castilleja minor (A. Gray) A. Gray. Lesser Indian paintbrush. Ephemeral; occasional along Cave Creek. 382, 465.

Orobanche cooperi (A. Gray) A. Heller. Louisiana broomrape. Ephemeral; rare. 642.

PAPAVERACEAE

Argemone pleiacantha Greene ssp. *ambigua* G. B. Ownbey. Southwestern pricklypoppy. Perennial; rare. 646.

Eschscholzia californica Cham. ssp. *mexicana* (Greene) C. Clark. [*E. mexicana* Greene]. California poppy, Mexican gold poppy. Ephemeral; occasional. 197, 357.

PHRYMACEAE

Mimulus guttatus Fisch. ex DC. Seep monkeyflower. [*M. nasutus* Greene]. Ephemeral; common in riparian areas. 384.

Mimulus rubellus A. Gray. Little redstem monkeyflower. Ephemeral; occasional. 409, 410.

PLANTAGINACEAE (includes SCROPHULARIACEAE, in part)

Keckiella antirrhinoides (Benth.) Straw. ssp. *microphylla* (A. Gray) Straw. [*Penstemon microphyllus* A. Gray]. Snapdragon penstemon. Shrub; occasional. 353.

Maurandya antirrhiniflora Humb. & Bonpl. ex Willd. [*Maurandella antirrhiniflora* (Humb. & Bonpl. ex Willd.) Rothm.] Roving sailor, Twining snapdragon. Perennial herb; occasional. 627.

Penstemon eatonii A. Gray ssp. *exsertus* (A. Nelson) D. D. Keck. Firecracker penstemon. Perennial herb; infrequent. 623, 638.

Penstemon palmeri A. Gray. Palmer's penstemon. Perennial herb; rare, found once on trailside. 655.

Penstemon pseudospectabilis M. E. Jones ssp. *connatifolius* (A. Nelson) D. D. Keck. Desert beardtongue. Perennial herb; infrequent. 367.

#*Penstemon subulatus* M. E. Jones. Hackberry beardtongue. Perennial herb; occasional. 212, 228.

Plantago ovata Forssk. [*P. insularis* Eastw.]. Desert indianwheat. Ephemeral; common. 204, 301.

Plantago patagonica Jacq. [*P. purshii* Roem. & Schult.]. Woolly plantain. Ephemeral; common. 314.

Plantago rhodosperma Decne. Redseed plantain. Ephemeral; occasional. 288.

Sairocarpus nuttallianus (Benth.) D. A. Sutton. [*Antirrhinum nuttallianum* Benth.]. Violet snapdragon. Ephemeral; occasional. 413.

Stemodia durantifolia (L.) Sw. Whitewoolly twintip. Ephemeral; occasional. 453, 608, 665.

Veronica americana Schwein. ex Benth. American speedwell. Perennial herb; rare. 526.

Veronica anagallis-aquatica L. Water speedwell. Perennial herb; common in riparian areas. 385.

Veronica peregrina L. Hairy purslane speedwell. Ephemeral; infrequent. 319.

PLATANACEAE

Platanus wrightii S. Watson. Arizona sycamore. Tree; occasional in riparian areas. 130.

POLEMONIACEAE

Allophylum gilioides (Benth.) A. D. Grant & V. E. Grant. [*Gilia gilioides* (Benth.) Greene]. Dense false gilyflower. Ephemeral; infrequent. 321, 430.

Eriastrum diffusum (A. Gray) H. Mason. Miniature woollystar. Ephemeral; occasional. 294, 326.

Eriastrum eremicum (Jeps.) H. Mason. Desert woollystar. Ephemeral; locally common to occasional. 300.

Gilia flavocincta A. Nelson ssp. *flavocincta*. [*G. ophthalmoides* Brand ssp. *flavocincta* (A. Nelson) A. D. Grant & V. E. Grant]. Lesser yellowthroat gilia. Ephemeral; locally common to occasional. 203, 250, 327.

Gilia stellata A. Heller. Star gilia. Ephemeral; occasional. 254, 308.

Ipomopsis multiflora (Nutt.) V. E. Grant. [*Gilia multiflora* Nutt.]. Manyflowered ipomopsis. Ephemeral; infrequent. 732.

Leptosiphon aureus (Nutt.) J. M. Porter & L. A. Johnson ssp. *aureus*. [*Linanthus aureus* (Nutt.) Greene]. Golden linanthus. Ephemeral; rare. 724.

Linanthus bigelovii (A. Gray) Greene. Bigelow's linanthus. Ephemeral; occasional. 278.

Linanthus demissus (A. Gray) Greene. Desertsnow. Ephemeral; infrequent. 293.

Microsteris gracilis (Douglas ex Hook.) Greene. [*Phlox gracilis* (Douglas ex Hook.) Greene]. Slender phlox. Ephemeral; infrequent. 619, 723.

Phlox tenuifolia E. E. Nelson. Santa Catalina Mountain phlox, Desert Phlox. Perennial herb; occasional. 347.

POLYGONACEAE

Chorizanthe brevicornu Torr. Brittle spineflower. Ephemeral; occasional. 205, 680.

Eriogonum abertianum Torr. Abert's buckwheat. Ephemeral; occasional. 198, 241.

#*Eriogonum arizonicum* S. Stokes ex M. E. Jones. Arizona buckwheat. Perennial herb; locally common to occasional. 511A, 537.

Eriogonum deflexum Torr. Flatcrown Buckwheat. Ephemeral; locally common to occasional. 401, 546.

Eriogonum fasciculatum Benth. var. *polifolium* (Benth.) Torr. & A. Gray. Eastern Mojave buckwheat. Flat-top buckwheat. Shrub; common. 310A.

Eriogonum inflatum Torr. & Frém. Desert trumpet. Perennial herb; occasional. 400.

Eriogonum palmerianum Reveal. Palmer's buckwheat. Ephemeral; infrequent. 675.

Persicaria lapathifolia (L.) Gray. [*Polygonum lapathifolium* L.]. Curlytop knotweed. Ephemeral; occasional in dry stream beds. 475, 504.

**Polygonum aviculare* L. Prostrate knotweed. Ephemeral; occasional. 415, 540.

Pterostegia drymarioides Fisch. & C.A. Mey. Woodland Pterostegia. Ephemeral; occasional. 248.

**Rumex crispus* L. Curly dock. Perennial herb; occasional in sandy riparian areas. 464, 523, 736.

Rumex hymenosepalus Torr. Canaigre dock, Desert rhubarb. Perennial herb; occasional. 192.

PORTULACACEAE (see also MONTIACEAE)

**Portulaca oleracea* L. Little hogweed, Common purslane. Ephemeral; infrequent. 731.

PRIMULACEAE

**Anagallis arvensis* L. Scarlet pimpernel. Ephemeral; rare on floodplain. 720.

Androsace occidentalis Pursh. Western rockjasmine. Ephemeral; occasional. 178.

RANUNCULACEAE

Anemone tuberosa Rydb. Tuber anemone, Desert anemone. Perennial herb; occasional. 227.

Delphinium parishii A. Gray. [*D. amabile* Tidestr.]. Parish's larkspur, Paleface delphinium. Perennial herb; occasional. 324.

Delphinium scaposum Greene. Tall mountain larkspur. Perennial herb; occasional. 325, 348.

Myosurus cupulatus S. Watson. Arizona mousetail. Ephemeral; occasional. 273.

RHAMNACEAE

Ceanothus vestitus Greene [*C. greggii* A. Gray var. *vestitus* (Greene) McMinn]. Desert ceanothus. Shrub; occasional on north face of Elephant Mountain. 621.

Ziziphus obtusifolia (Hook. ex. Torr. & A. Gray) A. Gray var. *canescens* (A. Gray) M. C. Johnst. [*Condalia lycioides* (A. Gray) Weberb. var. *canescens* (A. Gray) Trel.]. Lotebush, Gray thorn. Shrub; occasional. 396, 514.

ROSACEAE

Cercocarpus montanus Raf. var. *glaber* (S. Watson) F. L. Martin. [*C. betuloides* Nutt.]. Birchleaf mountain mahogany. Tree; occasional on upper slopes of north face of Elephant Mountain. 373.

RUBIACEAE

Galium aparine L. Stickywilly. Ephemeral; infrequent. 252, 257.

Galium microphyllum A. Gray. Bracted bedstraw. Perennial herb; occasional. 551.

Galium proliferum A. Gray. Limestone bedstraw. Ephemeral; infrequent. 253.

Galium stellatum Kellogg. Starry bedstraw. Shrub; occasional. 355.

SALICACEAE

Populus fremontii S. Watson. Fremont cottonwood. Tree; abundant in riparian areas. 614.

Salix gooddingii C. R. Ball. Goodding's Willow. Tree; abundant in riparian areas. 419.

Salix laevigata Bebb. Red willow. Tree; rare. 738.

SANTALACEAE

Phoradendron californicum Nutt. Mesquite mistletoe. Desert mistletoe. Perennial herb; common on *Acacia greggii*. 489.

SAPINDACEAE

Dodonaea viscosa Jacq. Florida hopbush. Shrub; infrequent. 492, 749.

SCROPHULARIACEAE, see also OROBANCHACEAE, PHRYMACEAE, and**PLANTAGINACEAE**

**Verbascum thapsus* L. Common mullein. Ephemeral; infrequent. 739.

SIMMONDSIACEAE

Simmondsia chinensis (Link) C. K. Schneid. Jojoba. Shrub; common. 146.

SOLANACEAE

Calibrachoa parviflora (Juss.) D'arcy. [*Petunia parviflora* Juss.]. Seaside petunia. Ephemeral; locally common to occasional in dry stream bed and floodplain. 393A, 408.

Datura wrightii Regel. Sacred thorn-apple, Sacred datura. Ephemeral; occasional. 454.

Lycium berlandieri Dunal. Berlandier's wolfberry. Shrub; occasional. 560, 563.

Lycium exsertum A. Gray. Arizona desert-thorn, Wolfberry. Shrub; common. 165, 307.

**Nicotiana glauca* Graham. Tree tobacco. Tree; rare, found once in dry stream bed. 734.

Nicotiana obtusifolia M. Martens & Galeotti. [*N. trigonophylla* Dunal; *N. palmeri* Gray]. Desert tobacco. Perennial herb; occasional. 457.

Solanum americanum Mill. American black nightshade. Ephemeral; infrequent. 524.

STERCULIACEAE, see MALVACEAE**TAMARICACEAE**

**Tamarix aphylla* (L.) H. Karst. Athel tamarisk. Tree; rare, small grove of tall trees on Cave Creek floodplain. 595.

**Tamarix chinensis* Lour. [*T. pentandra* Pall.; *T. ramosissima* Ledeb.] Five-stamen tamarisk, Saltcedar, Tamarisk. Shrub; occasional along Cave Creek, currently being managed for removal. 389, 547.

ULMACEAE, see CANNABACEAE**URTICACEAE**

Parietaria hespera B. D. Hinton var. *hespera*. Rillita Pellitory. Ephemeral; occasional. 181, 411.

VERBENACEAE

Aloysia wrightii A. Heller. Wright's beebrush, Oreganillo. Shrub; occasional. 566, 754.

Glandularia gooddingii (Briq.) Solbrig. [*Verbena gooddingii* Briq.] Southwestern mock vervain, Goodding's verbena. Perennial herb; occasional. 392.
Verbena bracteata Lag. & Rodr. Bigbract verbena. Ephemeral; rare. 721.
Verbena neomexicana Small var. *xylopoda* L. M. Perry. Hillside vervain. Perennial herb; infrequent. 653.

VISCACEAE, see SANTALACEAE

VITACEAE

Vitis arizonica Engelm. Canyon grape. Perennial herb; rare. 661.

ZYGOPHYLLACEAE

Kallstroemia grandiflora Torr. ex A. Gray. Arizona poppy. Ephemeral; infrequent. 535, 568.
Larrea tridentata (Sessé & Moc. ex DC.) Coville. Creosote bush. Shrub; common. 394.
 **Tribulus terrestris* L. Puncturevine, Goat's head. Ephemeral; rare. 726.

MONOCOTS

AGAVACEAE, see ASPARAGACEAE

ASPARAGACEAE (includes AGAVACEAE and THEMIDACEAE)

#*Agave chrysantha* Peebles. Goldenflower century plant. Succulent; rare, found once on north-facing hillside. 727.
Agave murpheyi F. Gibson. Murphey's century plant, Hohokam agave. Succulent; rare, found once in 2009. on south face of lower slope of Elephant Mountain, clone was dead. 607.
Dichelostemma capitatum (Benth.) Alph. Wood. [*D. pulchellum* (Salisb.) A. Heller]. Bluedicks, Desert hyacinth. Perennial herb; common. 193, 235.
Yucca baccata Torr. Banana yucca. Succulent; occasional. 376.

CYPERACEAE

**Cyperus involucratus* Rottb. Umbrella plant. Perennial herb; rare, found once in dry stream bed of Cave Creek. 698.
Schoenoplectus pungens (Vahl) Palla. [*Scirpus americanus* Pers.]. Common threesquare. Perennial herb; common along Cave Creek. 423, 477, 511.

JUNCACEAE

Juncus bufonius L. Toad rush. Ephemeral; occasional. 318.
Juncus torreyi Coville. Torrey's rush. Perennial herb; occasional. 479, 510.
Juncus xiphioides E. Mey. Irisleaf rush. Perennial herb; rare, in riparian areas. 735.

LILIACEAE

Calochortus kennedyi Porter var. *kennedyi*. Desert mariposa lily. Perennial herb; occasional. 330.

POACEAE

Aristida adscensionis L. Sixweeks threeawn. Ephemeral; occasional. 407.
Aristida purpurea Nutt. var. *parishii* (Hitchc.) Allred. Parish's threeawn. Perennial herb; occasional. 422, 438, 647.
Aristida purpurea Nutt. var. *purpurea*. Purple threeawn. Perennial herb; occasional. Purple threeawn. 611.
 **Arundo donax* L. Giant reed. Perennial herb; rare along Cave Creek. 752, Makings 3862.
 **Avena fatua* L. Wild oat. Ephemeral; locally common to occasional. 341.
Bothriochloa barbinodis (Lag.) Herter. [*Andropogon barbinodis* Lag.]. Cane bluestem. Perennial herb; occasional. 677.
Bouteloua aristidoides (Kunth) Griseb. Needle grama. Ephemeral; occasional. 360A, 567.
Bouteloua barbata Lag. var. *barbata*. Sixweeks grama. Ephemeral; occasional. 125.

Bouteloua barbata Lag. var. *rothrockii* (Vasey) Gould. [*B. rothrockii* Vasey]. Rothrock's grama. Perennial herb; infrequent. 578.

Bouteloua curtipendula (Michx.) Torr. Sideoats grama. Perennial herb; occasional. 580.

Bromus arizonicus (Shear) Stebbins. Arizona brome. Ephemeral; infrequent. 290B.

**Bromus berteroanus* Colla. [*B. triniti* É. Desv.]. Chilean chess. Ephemeral; infrequent. 290A.

**Bromus catharticus* Vahl. Rescuergrass. Ephemeral; occasional. 390.

**Bromus diandrus* Roth. [*B. rigidus* Roth]. Ripgut brome. Ephemeral; locally abundant to occasional. 391.

**Bromus rubens* L. [*B. madritensis* L. ssp. *rubens* (L.) Husn.]. Red brome. Ephemeral; locally abundant to common. 315, 328.

**Cenchrus ciliaris* L. [*Pennisetum ciliare* (L.) Link]. Buffelgrass. Perennial herb; rare. 565.

**Cenchrus setaceus* (Forssk.) Morrone. [*Pennisetum setaceum* (Forssk.) Chiov.]. Crimson fountaingrass. Perennial herb; infrequent in drainages. 472, 509.

**Cynodon dactylon* (L.) Pers. Bermudagrass. Perennial herb; common. 343.

Dasyochloa pulchella (Kunth) Willd. ex Rydb. [*Tridens pulchellus* (Kunth) Hitchc.; *Erioneuron pulchellum* (Kunth) Tateoka]. Low woollygrass. Perennial herb; occasional. 600, 643.

Digitaria californica (Benth.) Henrard. [*Trichachne californica* (Benth.) Chase]. Arizona cottontop. Perennial herb; occasional. 132.

Dinebra panicea (Retz.) P.M. Peterson & N. Snow ssp. *brachiata* (Steud.) P. M. Peterson & N. Snow. [*Leptochloa panicea* (Retz) Owhi ssp. *brachiata* (Steud.) N. Snow; *L. filiformis* (Pers.) P. Beauv.]. Mucronate sprangletop. Ephemeral; occasional. 120, 581.

Disakisperma dubium (Kunth) P. M. Peterson & N. Snow. [*Leptochloa dubia* (Kunth) Nees]. Green sprangletop. Perennial herb; occasional. 579.

**Echinochloa colona* (L.) Link. Jungle rice. Ephemeral; occasional. 123.

**Echinochloa crus-galli* (L.) P. Beauv. Barnyardgrass. Ephemeral; occasional. 460.

**Eragrostis ciliaris* (All.) Vignolo ex Janch. Stinkgrass. Ephemeral; occasional. 554, 586.

**Eragrostis lehmanniana* Nees. Lehmann lovegrass. Perennial herb; occasional. 119, 663.

Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult. Tanglehead. Perennial herb; infrequent. 600A.

Hilaria belangeri (Steud.) Nash var. *belangeri*. Curly-mesquite. Perennial herb; occasional. 569.

Hilaria mutica (Buckley) Benth. [*Pleuraphis mutica* Buckley]. Tobosagrass. Perennial herb; common. 481.

Hilaria rigida (Thurb.) Benth. ex Scribn. [*Pleuraphis rigida* Thurb.]. Big galleta. Perennial herb; common. 440.

**Hordeum murinum* L. ssp. *glaucum* (Steud.) Tzvelev. [*H. stebbinsii* Covas; *H. glaucum* Steud.]. Smooth barley. Ephemeral; locally common to occasional. 660.

Hordeum pusillum Nutt. Little barley. Ephemeral; locally common to occasional. 323, 659.

**Lolium multiflorum* Lam. [*L. perenne* L. ssp. *multiflorum* (Lam.) Husn.]. Italian ryegrass, Annual ryegrass. Ephemeral; infrequent. 459.

Muhlenbergia porteri Scribn. ex Beal. Bush muhly. Perennial herb; occasional. 564, 750.

Muhlenbergia rigens (Benth.) Hitchc. Deergrass. Perennial herb; common in riparian areas. 139, 590.

Panicum hirticaule J. Presl var. *hirticaule*. Mexiean panicgrass. Ephemeral; infrequent. 584.

Pappostipa speciosa (Trin. & Rupr.) Romasch. [*Stipa speciosa* Trin. & Rupr.; *Achnatherum speciosum* (Trin. & Rupr.) Barkworth; *Jarava speciosa* (Trin. & Rupr.) Peñail.]. Desert needle Grass. Perennial herb; common on upper slopes of north face of Elephant Mountain. 366.

**Phalaris minor* Retz. Littleseed canarygrass. Ephemeral; infrequent. 331.

Poa bigelovii Vasey & Scribn. Bigelow's bluegrass. Ephemeral; common. 281, 317, 342, 617.

**Polypogon monspeliensis* (L.) Desf. Annual rabbitsfoot grass. Ephemeral; locally common to occasional in riparian areas. 432.

**Polypogon viridis* (Gouan) Breistr. [*Agrostis semiverticillata* (Forsk.) C. Chr.]. Beardless rabbitsfoot grass. Perennial herb; occasional. 505.

**Schismus barbatus* (L.) Thell. Common Mediterranean grass. Ephemeral; common. 280, 615.

Setaria leucopila (Scribn. & Merr.) K. Schum. Streambed bristlegrass. Perennial herb; occasional. 577.

Sporobolus cryptandrus (Torr.) A. Gray. Sand dropseed. Perennial herb; occasional. 137, 538.

Tridens muticus (Torr.) Nash var. *muticus*. Slim tridens. Perennial herb; infrequent. 134.

Urochloa arizonica (Scribn. & Merr.) Morrone & Zuloaga. [*Panicum arizonicum* Seribn. & Merr.].

Arizona signalgrass. Ephemeral; rare. 585.

Vulpia microstachys (Nutt.) Munro var. *ciliata* (A. Gray ex Beal) Lonard & Gould. [*Festuca eastwoodiae* Piper; *F. microstachys* Nutt. var. *ciliata* A. Gray ex Beal]. Eastwood fescue. Ephemeral; occasional. 316.

Vulpia microstachys (Nutt.) Munro var. *pauciflora* (Scribn. ex Beal) Lonard & Gould. [*Festuca pacifica* Piper; *F. microstachys* Nutt. var. *pauciflora* Scribn. ex Beal]. Pacific fescue. Ephemeral; occasional. 298.

Vulpia octoflora (Walter) Rydb. var. *hirtella* (Piper) Henrard. [*Festuca octoflora* Walter]. Sixweeks fescue. Ephemeral; common. 239, 616.

TYPHACEAE

Typha domingensis Pers. Southern cattail. Perennial herb; occasional in riparian areas. 512.

XANTHORRHOEACEAE

**Aloe maculata* All. [*A. saponaria* Haw.]. Soap aloe. Succulent; rare, found once near bank of Cave Creek, but no longer present. 650.

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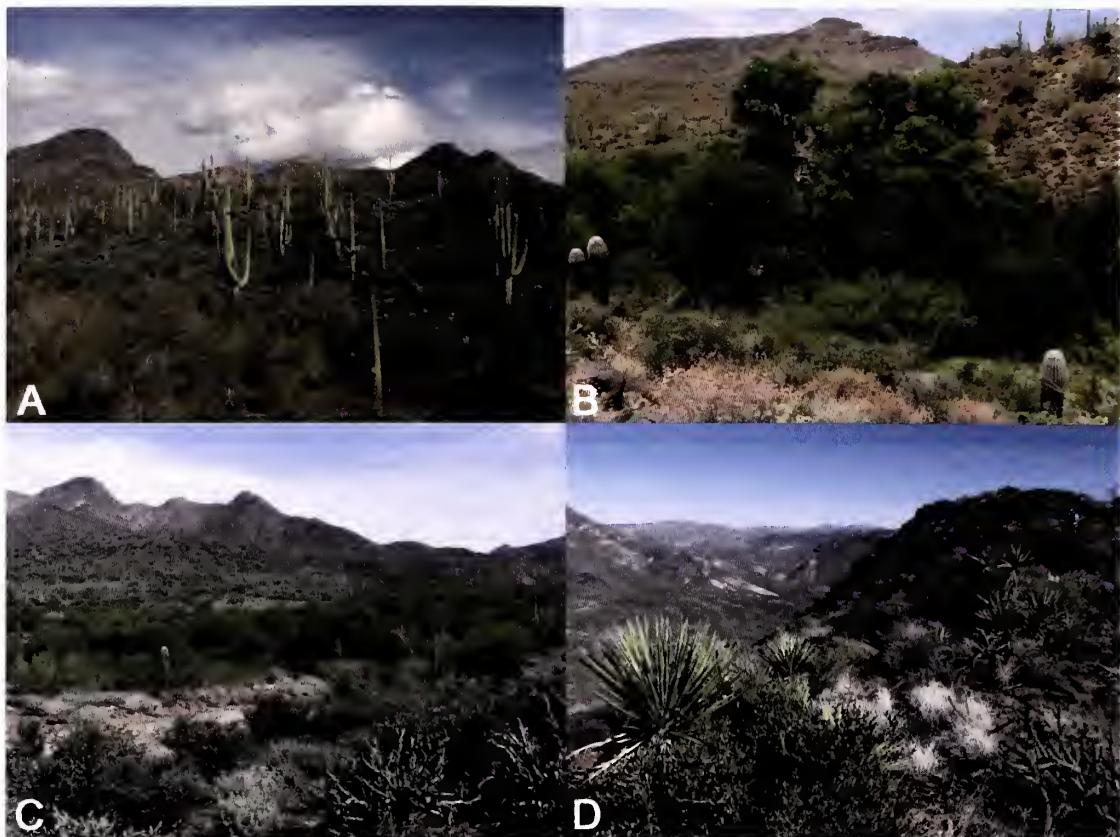


Figure 2. Types of Vegetation.

(A) Sonoran Desertscrub-Arizona Upland vegetation includes *Parkinsonia microphylla* (foothill paloverde), *Carnegiea gigantea* (saguaro), *Ambrosia deltoidea* (triangle bur ragweed), *Encelia farinosa* (brittlebush), *Opuntia engelmannii* (Engelmann's pricklypear) and *Cylindropuntia acanthocarpa* (buckhorn cholla). Sugarloaf Mountain on left. 10 Feb 2013.

(B) *Salix gooddingii* (Goodding's willow)-*Populus fremontii* (Fremont cottonwood) riparian habitat along Cave Creek. *Eriogonum fasciculatum* var. *polifolium* (flat-top buckwheat) in foreground, Elephant Mountain in background. 26 May 2013.

(C) A mesquite bosque, dominated by *Prosopis velutina* (velvet mesquite), lines part of Cave Creek. Elephant Mountain in background. 22 Apr 2012.

(D) Elephant Mountain summit, facing northeast. Sonoran Desertscrub Arizona Upland habitat intergrades with Interior Chaparral and Semi-Desert Grassland on the upper slopes of the north face. *Yucca baccata* (banana yucca), *Simmondsia chinensis* (jojoba), *Hilaria mutica* (tobosagrass) and *Cylindropuntia acanthocarpa* (buckhorn cholla) in foreground. 20 Jan 2008.

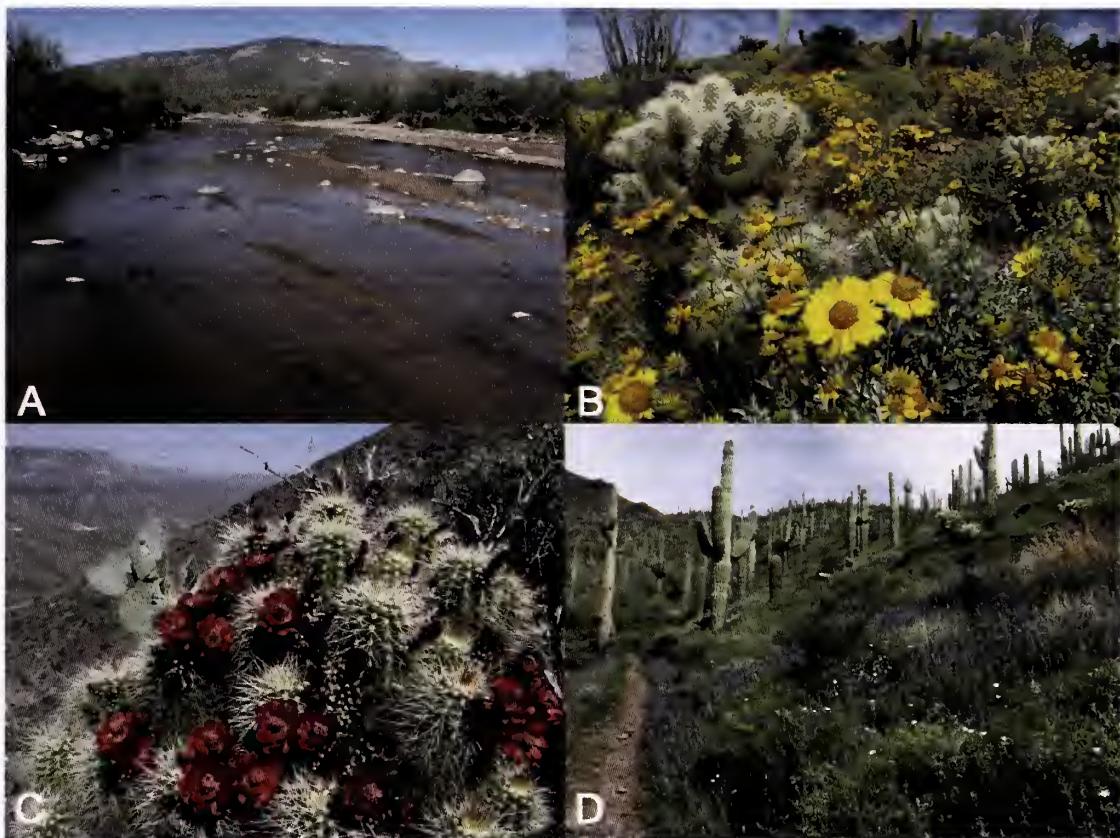


Figure 3. Additional images from Spur Cross Ranch Conservation Area.

(A) Cave Creek supports riparian habitats. Facing northeast, Skull Mesa in background. 20 Mar 2010.

(B) *Encelia farinosa* (brittlebush) displaying a mass of yellow flowers. A member of the Asteraceae, which is the best represented family in the flora, it is an abundant shrub in Arizona Upland Sonoran Desertsrub. *Cylindropuntia bigelovii* (teddybear cholla) in foreground, *Fouquieria splendens* (ocotillo) and *Carnegiea gigantea* (saguaro) in background. 30 Mar 2008.

(C) *Echinocereus yavapaiensis* (Yavapai claret-cup cactus) grows on the upper slopes of Elephant Mountain, and is one of the seven taxa in the study area which are endemic to Arizona. 20 Apr 2008.

(D) Spring ephemerals *Lupinus sparsiflorus* (Coulter's lupine, purple), *Rafinesquia neomexicana* (desert chicory, white), and perennial subshrub *Sphaeralcea ambigua* (desert globemallow, orange) along Spur Cross Trail. Ephemerals accounted for nearly half of the total taxa. 31 Mar 2010.

INDEX TO FAMILIES OF THE VASCULAR PLANTS OF ARIZONA

Bolded treatments are published in volumes 26, 27, 29, 30, 32, 33, and 35 of the *Journal of the Arizona-Nevada Academy of Science* (JANAS) or in subsequent volumes (e.g., 1–9) of CANOTIA. Unbolded entries indicate families with no treatments published to date. Figure numbers refer to illustrations in the “Key to Families of Vascular Plants in Arizona” in JANAS 35(2). Selected VPA treatments originally published in JANAS are also available as pdf files online (http://www.canotia.org/vpa_project.html).

Acanthaceae (Fig. 3)
Aceraceae JANAS 29(1):2. 1995. (L.R. Landrum)
 Adiantaceae (Fig. 1)
Agavaceae Part 1: *Agave* JANAS 32(1):1. 1999. (W. Hodgson)
 Aizoaceae Alismataceae Amaranthaceae (Fig. 4)
Anacardiaceae CANOTIA 3(2):13. 2007. (J.L. Anderson)
 Apiaceae (Fig. 5)
Apocynaceae JANAS 27(2):164. 1994. (S.P. McLaughlin)
 Araceae
 Araliaceae
Arecales JANAS 32(1):22. 1999. (C.T. Mason, Jr.)
 Aristolochiaceae JANAS 32(1):24. 1999. (C.T. Mason, Jr.)
 Asclepiadaceae JANAS 27(2):169. 1994. (E. Sundell)
 Aspleniaceae
 Asteraceae (Figs. 6–7)
Azollaceae CANOTIA 4(2):31. 2008. (G. Yatskiewych and M.D. Windham)
Berberidaceae JANAS 26(1):2. 1992. (J.E. LaFerriere; Fig. 9)
Betulaceae JANAS 33(1):1. 2001. (J.W. Brasher)
Bignoniaceae JANAS 32(1):26. 1999. (C.T. Mason, Jr.)
Bixaceae JANAS 27(2):188. 1994. (W. Hodgson)
Blechnaceae CANOTIA 4(2):35. 2008. (G. Yatskiewych and M.D. Windham; Fig. 1)
 Boraginaceae (Fig. 9)
 Brassicaceae
Bromeliaceae CANOTIA 3(2):23. 2007. (R. Gutierrez, Jr.)
 Buddlejaceae JANAS 26(1):5. 1992. (E.M. Norman)
 Burseraceae JANAS 32(1):29. 1999. (A. Salywon)
Cactaceae Part One: The Cereoid Cacti JANAS 29(1):6. 1995. (D.J. Pinkava)
Cactaceae Part Two: *Echinocactus* JANAS 29(1):13. 1995. (M. Chamberland)
Cactaceae Part Three: *Cylindropuntia* JANAS 32(1):32. 1999. (D.J. Pinkava)
Cactaceae Part Four: *Grusonia* JANAS 32(1):48. 1999. (D.J. Pinkava)
Cactaceae Part Five: *Pediocactus* and *Sclerocactus* JANAS 33(1):9. 2001. (K.D. Heil and J.M. Porter)
Cactaceae Part Six: *Opuntia* JANAS 35(2):137. 2003. (D.J. Pinkava).
 Callitrichaceae JANAS 29(1):15. 1995. (J. Ricketson)
 Campanulaceae
Cannabaceae JANAS 32(1):53. 1999. (C.T. Mason, Jr.)
 Capparaceae (Fig. 8)
 Caprifoliaceae (Fig. 10)
 Caryophyllaceae (Fig. 10)
Celastraceae JANAS 30(2):57. 1998. (J.W. Brasher)
Ceratophyllaceae JANAS 29(1):17. 1995. (J. Ricketson)
 Chenopodiaceae (Fig. 9)
 Clusiaceae
Commelinaceae JANAS 33(1):19. 2001. (R. Puente and R. Faden)
Convolvulaceae JANAS 30(2):61. 1998. (D.F. Austin)
 Cornaceae
Crassulaceae JANAS 27(2):190. 1994. (R. Moran)
 Crossosomataceae JANAS 26(1):7. 1992. (C. Mason)
 Cucurbitaceae (Fig. 10)
Cupressaceae JANAS 27(2):195. 1994. (J. Bartel)
 Cuscutaceae
 Cyperaceae (Fig. 18)
Dennstaedtiaceae CANOTIA 4(2):38. 2008. (G. Yatskiewych and M.D. Windham; Fig. 1)
Dipsaceae JANAS 27(2):201. 1994. (J.E. LaFerriere)
 Dryopteridaceae (Fig. 1)
 Elaeagnaceae
 Elatinaceae
 Ephedraceae (Fig. 2)
Ericaceae CANOTIA 4(2):21. 2008. (J.L. Anderson; Fig. 11)
Euphorbiaceae Part One: *Acalypha* and *Cnidoscolus* JANAS 29(1):18. 1995. (G.A. Levin)
Equisetaceae CANOTIA 4(2):41. 2008. (G. Yatskiewych and M.D. Windham)
Fabaceae Part One: *Errazuria*, *Marina*, *Parryella*, and *Psorothamnus* CANOTIA 7:1. 2011 (S. Rhodes, J. Beasley, and T. Ayers; Figs. 12–13)
Fagaceae JANAS 27(2):203. 1994. (L.R. Landrum)
Fouquieriaceae JANAS 32(1):55. 1999. (C.T. Mason, Jr.)
Fumariaceae JANAS 33(1):27. 2001. (S. Holiday and A. Perez)
Garryaceae JANAS 33(1):31. 2001. (R. Puente and T.F. Daniel)
Gentianaceae JANAS 30(2):84. 1998. (C.T. Mason, Jr.)
 Geraniaceae (Fig. 14)
 Grossulariaceae
 Haloragaceae
Hippuridaceae JANAS 29(1):25. 1995. (J. Ricketson)
 Hydrangeaceae
 Hydrocharitaceae
 Hydrophyllaceae (Fig. 14)
Iridaceae Part One: *Sisyrinchium* JANAS 27(2):215. 1994. (A.F. Cholewa and D.M. Henderson)
Iridaceae Part Two: *Iris* and *Nemastylis* JANAS 33(1):35. 2001. (C.T. Mason, Jr.)
Isoëtaceae CANOTIA 5(1):27. 2009. (G. Yatskiewych and M.D. Windham)
Juglandaceae JANAS 27(2):219. 1994. (J.E. LaFerriere)
 Juncaceae (Fig. 19)
 Juncaginaceae
 Key to Families of Vascular Plants in Arizona JANAS 35(2):88. 2003. (D.J. Keil)
Krameriaceae JANAS 32(1):57. 1999. (B.B. Simpson and A. Salywon)
Lamiaceae Part One: *Agastache*, *Hyptis*, *Lamium*, *Leonurus*, *Marrubium*, *Monarda*, *Monardella*, *Nepeta*, *Salazaria*, *Stachys*, *Teucrium*, and *Trichostema* JANAS 35(2):151. 2003. (C.M. Christy, D.Z. Damrel, A. Henry, A. Trauth-Nare, R. Puente-Martinez, and G. Walters)
Lemnaceae JANAS 26(1):10. 1992. (E. Landolt)
Lenoaceae JANAS 27(2):220. 1994. (G. Yatskiewych)
Lentibulariaceae CANOTIA 8(2):54–58. 2012. (B. Rice)
 Liliaceae (Fig. 19)
 Linaceae
Loasaceae JANAS 30(2):96. 1998. (C.M. Christy)
 Lythraceae
 Malpighiaceae
Malvaceae Part One: All genera except *Sphaeralcea*. JANAS 27(2):222. 1994. (P.A. Fryxell)
Marsileaceae CANOTIA 5(1):30. 2009. (G. Yatskiewych and M.D. Windham)
Martyniaceae CANOTIA 3(2):26. 2007. (R. Gutierrez, Jr.)
 Meliaceae
Menispermaceae JANAS 27(2):237. 1994. (J.E. LaFerriere)
Menyanthaceae JANAS 33(1):38. 2001. (C.T. Mason, Jr.)
Monotropaceae JANAS 26(1):15. 1992. (E. Haber)
Molluginaceae JANAS 30(2):112. 1998. (C.M. Christy)
 Moraceae
 Najadaceae
 Nyctaginaceae (Fig. 14)
Nymphaeaceae JANAS 29(1):26. 1995. (J. Ricketson)
 Oleaceae (Fig. 15)

Onagraceae (Fig. 15)

Ophioglossaceae

Orchidaceae

Orobanchaceae

Oxalidaceae JANAS 30(2):115. 1998. (R. Ornduff and M. Denton)

Papaveraceae JANAS 30(2):120. 1998. (G.B. Ownbey with contributions by J.W. Brasher and C. Clark)

Passifloraceae JANAS 33(1):41. 2001. (J.M. MacDougal)

Phytolaccaceae JANAS 33(1):46. 2001. (V. Steinmann)

Pinaceae

Plantaginaceae JANAS 32(1):62. 1999. (K.D. Huisenga and T.J. Ayers)

Platanaceae JANAS 27(2):238. 1994. (J.E. LaFerriere)

Plumbaginaceae

Poaceae (Fig. 20)

Polemoniaceae CANOTIA 1:1. 2005. (D. Wilken and M. Porter)

Polygonaceae

Polygonaceae (Fig. 15)

Polypodiaceae CANOTIA 5(1):34. 2009. (G. Yatskiewych and M.D. Windham; Fig. 1)

Pontederiaceae JANAS 30(2):133. 1998. (C.N. Horn)

Portulacaceae CANOTIA 2(1):1. 2006. (A. Bair, M. Howe, D. Roth, R. Taylor, T. Ayers, and R.W. Kiger)

Potamogetonaceae

Primulaceae JANAS 26(1):17. 1992. (A.F. Cholewa; Fig. 16)

Psilotaceae CANOTIA 3(2):32. 2007. (R. Gutierrez, Jr.)

Pyrolaceae JANAS 26(1):22. 1992. (E. Haber)

Rafflesiaceae JANAS 27(2):239. 1994. (G. Yatskiewych)

Ranunculaceae (Fig. 15)

Resedaceae

Rhamnaceae CANOTIA 2(1):23. 2006. (K. Christie, M. Currie, L. Smith Davis, M-E. Hill, S. Neal, and T. Ayers)

Rosaceae Part One: *Rubus*. JANAS 33(1):50. 2001. (J.W. Brasher)

Rubiaceae JANAS 29(1):29. 1995. (L. Dempster and E.T. Terrell; Fig. 16)

Ruppiaceae

Rutaceae

Salicaceae Part One: *Populus*. JANAS 26(1):29. 1992. (J.E. Eckenerwalder)

Salicaceae Part Two. *Salix*. JANAS 29(1):39. 1995. (G.W. Argus)

Salviniaceae CANOTIA 4(2):50. 2008. (G. Yatskiewych and M.D. Windham)

Santalaceae JANAS 27(2):240. 1994. (J.E. LaFerriere)

Sapindaceae JANAS 32(1):76. 1999. (A. Salywon)

Sapotaceae JANAS 26(1):34. 1992. (L.R. Landrum)

Saururaceae JANAS 32(1):83. 1999. (C.T. Mason, Jr.)

Saxifragaceae JANAS 26(1):36. 1992. (P. Elvander; Fig. 16)

Scrophulariaceae (Fig. 17)

Selaginellaceae CANOTIA 5(1):39. 2009. (G. Yatskiewych and M.D. Windham)

Simaroubaceae JANAS 32(1):85. 1999. (J.W. Brasher)

Simmondsiaceae JANAS 29(1):63. 1995. (J. Rebman)

Solanaceae Part One: *Datura*. JANAS 33(1):58. 2001. (R. Bye)

Solanaceae Part Two: Key to the Genera and *Solanum*. CANOTIA 5(1):1. 2009. (S.T. Bates, F. Farruggia, E. Gilbert R. Gutierrez, D. Jenke, E. Makings, E. Manton, D. Newton, and L.R. Landrum)

Solanaceae Part Three: *Lycium*. CANOTIA 5(1):17. 2009. (F. Chiang and L.R. Landrum)

Solanaceae Part Four: *Physalis* and *Quinula*. CANOTIA 9:1-12. 2013. (L.R. Landrum, A. Barber, K. Barron, F.S. Coburn, K. Sanderford, and D. Setaro)

Solanaceae Part Five: *Chamaesaracha*. CANOTIA 9:13-15. 2013. (E. Manton)

Sparganiaceae JANAS 33(1):65. 2001. (J. Ricketson)

Sterculiaceae

Tamaricaceae

Thelypteridaceae CANOTIA 5(1):49. 2009. (G. Yatskiewych and M.D. Windham)

Tiliaceae

Typhaceae JANAS 33(1):69. 2001. (J. Ricketson)

Ulmaceae JANAS 35(2):170. 2003. (J.W. Brasher)

Urticaceae JANAS 26(1):42. 1992. (D. Boufford)

Valerianaceae

Verbenaceae

Violaceae. JANAS 33(1):73. 2001. (R.J. Little; Fig. 17)

Viscaceae JANAS 27(2):241. 1994. (F.G. Hawksworth and D. Wiens)

Vitaceae

Zannichelliaceae

Zygophyllaceae (Fig. 17)